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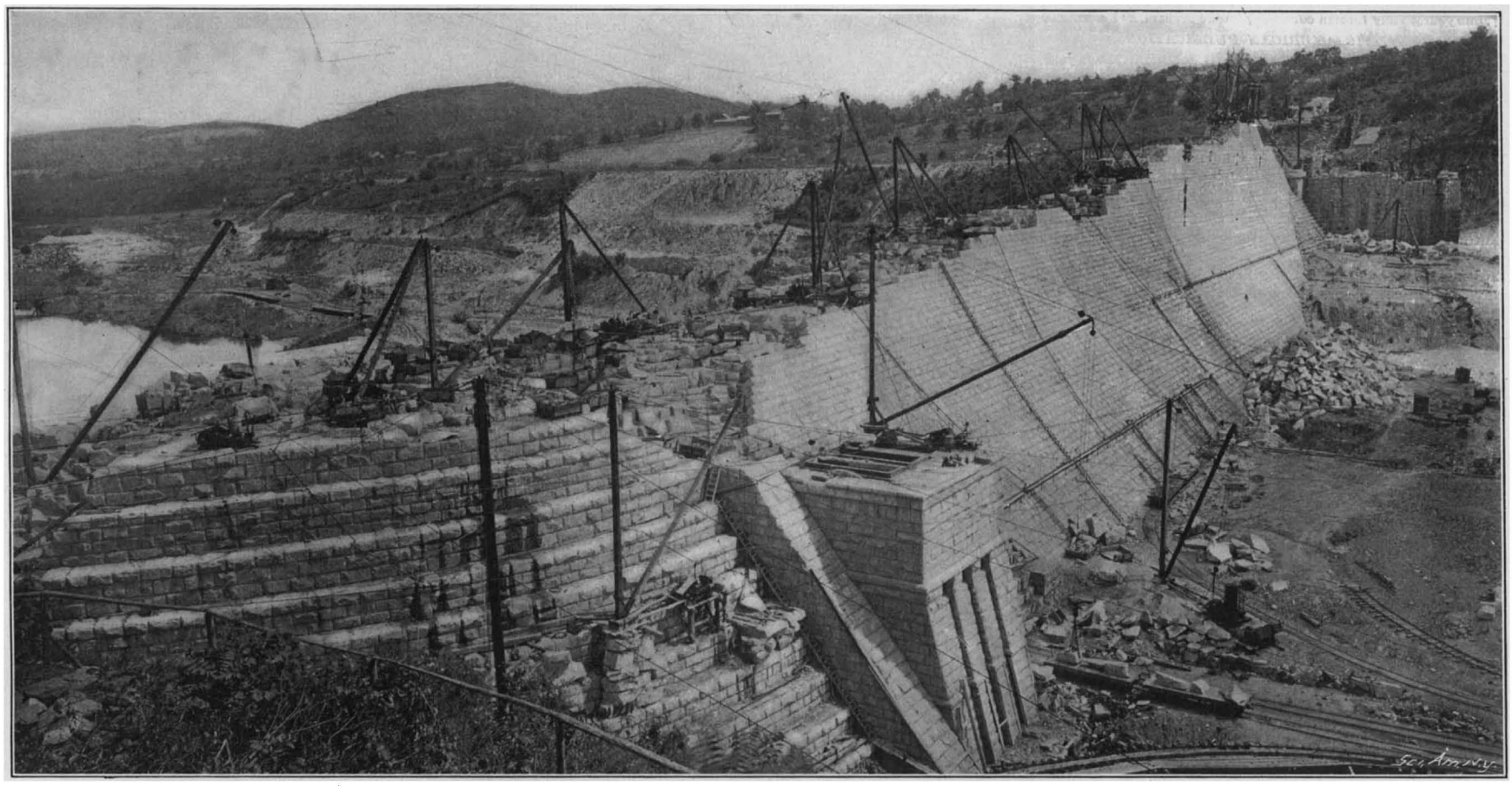
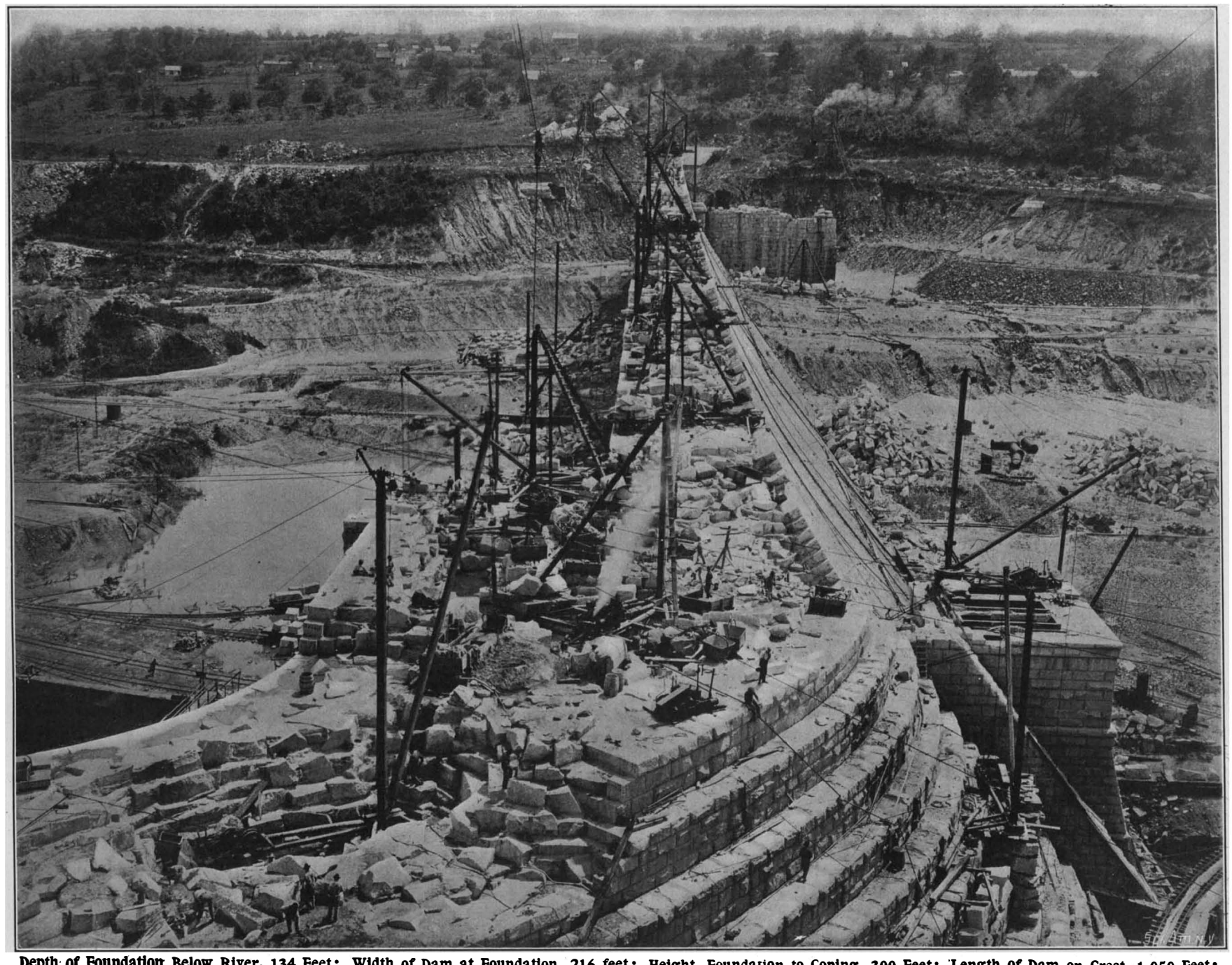
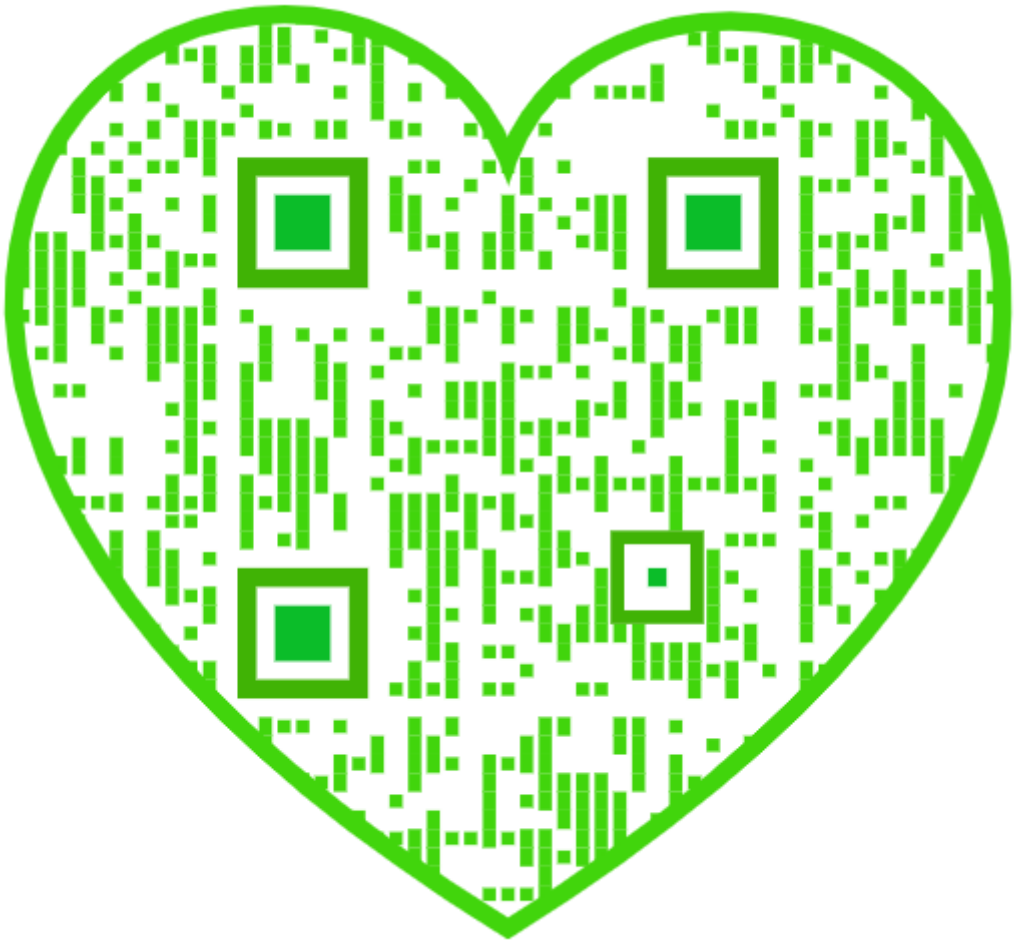


The Downstream Face of the Dam, Showing Commencement of Spillway and Headgate.



Depth of Foundation Below River, 134 Feet; Width of Dam at Foundation, 216 feet; Height, Foundation to Coping, 300 Feet; Length of Dam on Crest, 1,050 Feet; Length of Spillway, 1,000 Feet.

THE GREAT CROTON DAM FOR THE WATER SUPPLY OF NEW YORK CITY.—[See page 182.]



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NEW YORK, SATURDAY, SEPTEMBER 21, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

"GOD'S WILL BE DONE—NOT OURS."

For the third time in the history of this Republic we are called upon to endure the unspeakable anguish of seeing a beloved President stricken in our midst by the hand of the assassin.

Lincoln! Garfield! and now McKinley! Surely the cup of our national sorrow has been filled to the brim.

It will not be given to many of us to look again upon the face of our martyred President; nor need we. In affectionate and reverent memory we shall carry the image of that face—so dignified, grave, gentle and sincere—and, carrying it with us, we shall realize with tender sorrow that there has passed out from our midst a leader, truly wise and great; one of whom posterity will repeat that his record is chronicled not less in the deep, personal love of his people, than in the lofty purpose and spotless integrity of his official life.

Particular pathos will always attach to this tragic event from the fact that it could scarcely have happened if the President had not so freely and trustfully mingled with the people, and exposed himself to that very form of death to which he fell a victim. "Of the people, by the people, for the people"—only once, surely was there a President who, so assiduously and with such evident sincerity, sought to keep in personal touch with the citizens of the workaday world. The promiscuous handshaking with the Chief Executive, for which no parallel exists in any other country, affords an unrivaled opportunity for the stroke of the assassin. In no other country would it be allowed, or, if allowed, be possible. To the American people, however, this custom is the expression of one of the most cherished traditions of their national life; and the fact, truly pathetic, that our beloved President has died a martyr to his zealous fidelity to this national observance will give an added luster to his memory, which will brighten with the lapse of years.

Alas! what more shall we say of him. As we look upon that poor, stricken form, we feel that to indulge in wordy panegyric would be to trifle with a sacred theme. To say that he was statesmanlike, sagacious, patient, broad-minded, conscientious, lovable, and supremely patriotic—in a word a Christian and an American—and that his character was rounded out by an unaffected and all-pervading humility, is to summarize but a few of the public and private virtues which will cause posterity to proclaim him, as we do now, one of the most illustrious and beloved Presidents on the roll of the American Republic.

For seven long days the American people have watched by the bedside of their President; and, now that the end has come, they join with him in those last words, so characteristic of the man: "God's will be done—not ours."

PROPOSED REMODELING OF THE CROTON DAM.

The mere suggestion that there are serious defects in the design of the great Croton Dam will come as a surprise to those who are conversant with the history and character of this famous structure. The dam, although not the longest, is the loftiest in existence, and in all the history of similar structures there has been no parallel to the enormous amount of excavation which has been necessary before a reliable rock foundation could be secured. The greater part of the dam is of solid masonry construction, and its cross-section and the first-class nature of the work are such as to place its stability beyond the shadow of a doubt. Unfortunately, considerations of economy led to the construction of about 400 feet of the dam on a system which, while it was favorable as to cost, was, to say the least, doubtful as to stability and permanence. The solid masonry structure gives place, on the southerly 400 feet of the dam, to an earthen embankment with a thin, vertical, masonry, diaphragm in its center. While many earthen dams of this character have been built and are giving good service, there is no record of the system being used on a work of the great size and importance of the Croton Dam. Moreover, it is considered that the abrupt transition from the solid masonry to the composite structure introduces elements of risk which might lead to ultimate failure. The engineer in charge of the work, in recommending to the commissioners that an expert board of engineers be appointed to examine the dam, and report upon the desirability of carrying the masonry structure entirely across the valley, is evidently prompted by the same misgivings which many engineers have felt regarding the dual system of construction ever since the plans were first made public; and we are of the opinion that the consequence of failure in the way of a water famine would be so serious a matter to New York city, that the few months' delay, and the increased expenditure of half a million dollars involved in the requested change, should not be allowed to stand in the way for one moment. The expert commission consists of three well-known engineers, and is presided over by Mr. J. J. R. Croes, president of the American Society of Civil Engineers. The findings of this body will certainly be awaited with no little interest by those who realize the vast interests which are at stake in the present discussion.

A GREAT SALVAGE FEAT.

The recent arrival and departure from this port of the American Line steamship "Philadelphia" marks the successful climax of a feat of salvage which is in many respects the most remarkable ever achieved. It will be remembered that two years ago the steamship "Paris," while on her way from Cherbourg to New York, ran upon the dangerous submerged rocks on the south coast of England known as the "Manacles," where she remained, hard and fast, and exposed to the full fury of the Atlantic storms for a period of several months. She was finally floated by a German salvage company and towed to the shipyards of Harland & Wolff at Belfast. The constant pounding on the rocks destroyed a large section of her double bottom, and it was decided that the repairs should include a thorough reconstruction of the vessel. Advantage was taken of the opportunity to give her a complete set of new engines and boilers, besides thoroughly overhauling and renovating the ship from stem to stern. The external appearance of the "Philadelphia," as she is now named, is changed by the substitution of two smokestacks in place of the three she formerly carried. The stern also has been remodeled and considerably widened in the region of the propellers, so as to bring the latter entirely inboard.

The underwater changes consisted of the thorough reconstruction of the double bottom, the insertion of new keel, bilges, and frames where required, and the carrying out of the plating of the hull around the propeller shafts so as to form complete tunnel ways extending to the boss of the propellers. Quadruple-expansion engines have taken the place of the old triple-expansion, and a complete battery of new boilers has been installed. The present horse power of the vessel is 20,000, as against the old indicated horse power of 18,000, and when the engines have worn down to their bearings it is intended to drive the vessel at a sustained sea speed of 21 knots an hour. The best day's run on her maiden trip, when the engines were not pushed, was 19.9 knots an hour. The first and second cabins have been decorated with hardwood and embossed leather, and the removal of one of the three smokestacks and other structural changes have increased the passenger accommodation, and have brought the "Paris" up to the full pitch of excellence of a modern, first-class transatlantic liner. Those who saw this handsome vessel steaming down the harbor found it difficult to realize that only two years ago she was lying an apparently hopeless wreck upon the rocks of the English coast.

CANAIGRE GROWING IN THE UNITED STATES.

There is every indication that the world's supply of tannin is destined shortly to be derived from a new source. The substances which are used comprise mostly oak and hemlock barks, gambier, sumac and their extracts. Last year 136,284 tons of tannin material were consumed in England alone, while in the United States the consumption was about 1,500,000 tons. With the increase in the demand for leather, the accessible supply of tanning substances has not kept pace, and both practical tanners and men of science have been searching not only the vegetable kingdom, but also the domain of chemistry, to discover new ways of producing tannic acid. This has at last been discovered in canaigre (Rumex hymenosepalus). Canaigre is a corruption of "cana agria," or sour cane, by which the plant is known to the Mexicans. The plant is an annual, being planted and harvested in the crop form, and is, therefore, not subjected to slow growth as a tree. It is a bulb or tuber akin to the potato or dahlia, growing under cover of the earth and sending up a stalk and mass of leaves to a height of from 15 inches to 3 feet above the surface. It is a remarkable root in appearance, and it is indigenous to the arid plains of New Mexico, Arizona and California. The Agricultural Department in 1878 analyzed the root and noted its large percentage of tannic acid. This resulted in the shipment of a quantity of the roots to Germany. It was found that they arrived in more or less fermented and spoiled condition. Subsequently the roots were sliced and dried, and they now reach their destination abroad in excellent condition. In time the shipment amounted to 800 carloads. The roots contain 35 per cent of tannic acid.

The next step was to extract the tannic acid from the roots and ship the extract instead of the roots. Canaigre is now regularly cultivated, and in the current number of our SUPPLEMENT will be found a most interesting illustrated description, showing the roots in cultivation and the gathering of the wild canaigre. The article is from the pen of Mr. J. E. Bennett.

RAPID DEVELOPMENT OF WIRELESS TELEGRAPHY.

The recent successful transmission of wireless messages to and from the steamship "Lucania" when she was yet 200 miles from the port of New York, brought home vividly to the people of this city the fact, perhaps too little recognized, that the new system is commercially a marked success and a decided contribution to the safety and convenience of modern ocean travel.

The history of practical wireless telegraphy commenced, as far as this country is concerned, with the International Yacht Races of 1899, when, thanks to the enterprise of The New York Herald, the hourly position of the yachts was reported from the race-course off Sandy Hook to this city, and forwarded thence throughout the whole world. The necessary apparatus was fitted on board the steamer "Grande Duchesse," and the messages transmitted from the vessel were taken up by the wireless station on Navesink Highlands, whence they were sent over the ordinary telegraph wires to the office of the Herald. No application of wireless telegraphy of any great importance had been made in this country since 1899 until the recent installing, under the same auspices, of a station on the Nantucket Shoals lightship for the purpose of communicating with incoming ocean steamers. The Nantucket lightship is stationed about 40 miles south from Siasconset on the island of Nantucket. At the highest point in the village is a mast which carries 180 feet of vertical wire, the receiving and transmitting instruments being located in a cottage near the base of the mast. Aboard the lightship is a vertical wire 106 feet in length and the necessary instruments to complete the installation. With this apparatus it was found possible to communicate with the steamship "Lucania" when that vessel was 72 miles east of Nantucket, and within half an hour after the lightship was in touch with the vessel the ship was able to communicate with New York city, the distance from the "Lucania" to her destination being then approximately 200 miles. For several hours messages were exchanged between New York and the passengers on the ship, who were able to obtain a summary of events which had happened since the ship received its last wireless communication from the Irish coast at the commencement of the voyage. The successful carrying out of this experiment has the immediate result of lessening by more than half a day the period of time during which a transatlantic steamer is cut off from communication with the outside world.

Considering its revolutionary character, the success of wireless telegraphy has been unusually rapid, for it was only as recently as the summer of 1896 that Marconi, then but twenty-two years of age, landed in England in the hope of interesting the government in his invention and having an opportunity to demonstrate on a large scale its practical value. Thanks to the instant appreciation and encouragement of some of the leading electrical experts of that country, Marconi was able to make the necessary experiments on a large scale, and in the year 1898 he succeeded in dispatching a message over a distance of 34 miles between two points in England. It was not until March of the following year, when Marconi established communication across the English Channel, that the new system attracted the attention of the world at large and demonstrated its great commercial possibilities. Subsequent developments have included the successful transmission of messages between warships at sea and between merchant vessels and the shore; while the range of the system has grown so rapidly that in June of this year messages were exchanged between two stations in England which were 223 miles apart. Although

Marconi has always been extremely conservative in his estimate of the range to which his system may be extended in the future, the rapid increase in distance covered which has taken place in the past twelve months gives hope that the limit is far from having been approached.

THE NEW FRENCH LINER "LA SAVOIE."

So rapid is the increase in the fleets of the great transatlantic companies that the advent of a new, first-class vessel ceases to cause the decided sensation which marked the arrival of such a vessel only a decade ago. This falling off of public interest is not due to any decrease in the size, speed or appointments of the modern liner, but merely to the rapid succession in which the new vessels make their appearance in New York Harbor.

Of recent years all the leading companies have added to their fleets, either singly or in pairs, high-speed vessels which have been a great advance upon any previously owned by these lines. First came the "City of Paris" and the "City of New York," of the old Inman and International Line; then followed the "Teutonic" and "Majestic," of the White Star Line; the Cunarders "Campania" and "Lucania;" the North German Lloyd "Kaiser Wilhelm;" the White Star liner "Oceanic," and the Hamburg-American "Deutschland." The latest pair of crack ships to sail for New York are the "Lorraine" and "La Savoie," of the Compagnie Générale Transatlantique. The first-named made her maiden trip to this port last year, at which time she was described in our columns. The sister ship, "La Savoie," has just completed her first round voyage, and has taken her place in the front rank for speed, by crossing the Atlantic at an average of 21½ knots an hour, her speed developed on trial having been more than a knot greater than this.

The vessels of this company do not reach the great proportions of those of the German and English lines, and this simply for the reason that the capacity of the port of Havre, both in respect of depth of water and dock accommodations, puts a limit both upon draft and length. As a matter of fact, "La Savoie" has the largest dimensions that can be accommodated at the French port, as 5 feet more of length and a foot or two more of draft would shut her out of the docks altogether. "La Savoie" is 580 feet in length over all; 60 feet in beam; she has a depth of 39.6 feet; there are six decks, and she is built with sixteen transverse and one longitudinal watertight bulkheads. The motive power consists of two sets of triple-expansion engines, each engine having one high-pressure, one intermediate, and two low-pressure cylinders. The shafts are of nickel steel; the propellers measure 21 feet 5 inches in diameter and are three-bladed, the blades of bronze and the hubs of cast steel. On the trial trip "La Savoie" developed over 22,000 horsepower, and attained a speed of over 22½ knots an hour. The displacement of the vessel is 15,300 tons. There is accommodation for 446 first-class passengers, 116 second-class, and 400 third-class. The dining rooms, both first and second-class, are located on the main deck, and the smoking rooms on the promenade deck. The passenger accommodation includes many novel features, the most striking and commendable of which is that every stateroom has at the head of the bed a telephone communicating directly with the steward's room. This is a step in the right direction which will commend itself to all who have had any experience in ocean travel; it remains for some company to introduce elevators in order to bring ocean travel literally up to the comfort and convenience of first-class hotels on shore. That important feature of the modern liners, the decoration, has been carried out with the quiet taste which is characteristic of all French work of this kind. The external appearance of the ship is decidedly handsome. She has a graceful sheer, and the location of the smokestacks and the masts has evidently been determined with an eye to giving a well-balanced effect in a broadside view of the vessel.

GERMANY'S COMMERCIAL DEPRESSION—ITS CAUSES AND EFFECTS.

The British Foreign Office has received from its Consul-General, Mr. Francis Oppenheimer, at Frankfort-on-Main, an interesting and exhaustive report dealing with the commerce and trade of Germany. Therein the Consul gives an elaborate résumé of the remarkable and rapid progress of the country within the past few years, and its present unsatisfactory condition.

Germany's industrial progression started in the year 1894, and until 1900 continued with wonderful uninterruptedness. The demand for German articles was prodigious, and orders accumulated and increased so rapidly that the markets of the world were flooded with the products of German industry. Prices, however, remained normal, and the extraordinary sale of German goods was probably due to the low price. In 1900, however, occurred a famine in coal and iron, which constitute the fundamental bases of all industries. Considerable anxiety ensued as to what would happen, and several interesting debates were held in the Imperial Diet concerning the question. Public confidence, however, was restored, and a continuance of prosperity was anticipated.

The Consul-General advances two reasons for the justification of this opinion. "There has been," he states, "a remarkable increase in the number of industrial enterprises, the result of which was fresh and more work for great and small industries." The other reason resulted from "the formation of numerous syndicates." As this country is the land of trusts, so Germany is the country of syndicates. There is scarcely a ramification of trade the members of which have not combined for the regulation and control of prices, and even the quantity of output has been regulated by them. Protected by tariffs the syndicates have been enabled to inflate their prices to that limit which just renders foreign importation and competition impossible. Another means of preventing foreign competition is that the syndicates refuse to supply any customers who purchase similar articles from foreign manufacturers. The retailer must obtain all his goods from the home manufacturer, or be boycotted. The result of this industrial despotism is that the retailer is considerably limited in the choice of his source of supply, while the foreign competitor finds no market for his goods. Another serious phase of the situation is that the home retailer discovered that while he was paying tremendous prices for his goods, the same articles were being placed upon the foreign markets at a ridiculously low figure, which absolutely precluded the manufacturer from reaping any profit. In short, the retailer was not only paying dearly for his goods, but he was also paying for the loss that the manufacturers were incurring in the foreign markets.

Such a condition of affairs could have but one outcome. The inevitable result has ensued. The manufacturers, secure from foreign competition by the protective tariffs, have increased their prices to such an extent that now they have attained an unenviable and absolutely untenable position. The retailer refuses to pay the exorbitant prices, with the result that the demand has considerably decreased. The commercial depression which at first was considered to be only temporary in character has now developed into a matter of grave importance. In the early part of 1900 it was impossible to obtain sufficient labor to cope with the orders in hand. Now it is difficult to find adequate work for the laborers. Some industries, such as coal mining, are still fully occupied, but others, such as the iron trade, are experiencing serious times. The staffs are being considerably reduced, and wages are declining. Unless something unforeseen happens in the near future to revive the prosperity of the country serious situations will develop. The unemployed problem will become acute. The government has endeavored to save the situation by levying new tariffs and increasing old ones, but reprisals from other countries are promised if such drastic measures are enforced. And for all this the syndicates are entirely responsible. Had they not assumed such an intolerably despotic attitude no such crisis would have developed. Money has become so dear that it is impossible for any profits to be made. The first industry to suffer from this tendency was the building trade. Builders were unable to raise on mortgages at a rate that would leave them even a small margin of profit. The result was that work in this line came to a standstill. Cessation of work in this trade affected the iron, glass, cement, stone, and cognate industries. Once the canker set in it has rapidly spread, and all efforts to stem the tide of depression have so far been completely nullified. The public have now painfully realized that the syndicates have failed to bestow those benefits which for times of trouble had in theory been anticipated, and their power and influence on the markets is now regarded more as an evil rather than a blessing.

The Consul-General opines that the high-water mark of German prosperity has been attained not by chance, but systematically and scientifically, and he states that Germans may well be proud of what they have achieved in comparatively so short a span of time. He advances, however, a word of warning. The increase of the tariffs will result in the absolute exclusion of the foreigner, while the syndicates will take immediate advantage of the augmentation of the customs to increase their prices. The British exporters have felt the effect of the tariff considerably, but they are now surmounting the difficulty in the only possible manner, and one that is likely to affect the syndicates very severely. Several British manufacturers who cannot manufacture their goods in England to sell them profitably in Germany are establishing branch works in Germany. They can there compete with the syndicates upon their own ground and upon the same terms. The English manufacturer now undersells the syndicate at a price which is highly profitable to himself, and since he has to recoup no losses incurred by forcing another or foreign market, it cannot be described as unfair competition. Already several British firms have branch works in Germany, and, owing to the success that has attended this policy, several other firms who have hitherto had an extensive trade with Germany, but which has been killed through excessive tariffs, are emulating their efforts. When this competition becomes sufficiently powerful the syndicates will experience serious times and will eventually be crushed. The English firms may suffer somewhat in the output of their English factories owing to the establishment of such branch works, but it will enable them to direct their attention to new markets, where there is no opposition by heavy protective tariffs.

The Consul-General strongly condemns the policy of organizing industries into syndicates or trusts. The home country must be the sufferer in the long run, as Germany has now found out to its cost, and eventually such combinations will be killed, and the home trade pass more completely into the hands of the foreigner.

SCIENCE NOTES.

A deposit of prehistoric ivory has been discovered in Alaska.

M. Deutsch, the donor of the hundred thousand francs prize for the aeronaut who succeeds in making the trip from St. Cloud to the Eiffel Tower and return in thirty minutes, is considering the advisability of modifying the original conditions, owing to the danger of maneuvering over Paris. The line of route may be changed so as to go around Mt. Valerian, starting and returning to St. Germain, Paris.

J. B. Nagelvoort has recently stated (Nederl. Tijdsch. v. Pharm.) that colchicum flowers contain as much as 0.1 per cent of colchicine, which is nearly ten times as much as has been hitherto found. Since, however, he has merely relied upon color reactions for the alkaloid, and does not appear to have determined its melting point, the statement must be accepted with reserve, since the purity of his alkaloid is open to question.—Pharm. Zeit.

The Colorado Cliff Dwellers' Association is making every effort to preserve the ruins which lie on the Mesa Verde, in southwestern Colorado. There are from three hundred to four hundred cliff dwellers, including the cliff palace on this Mesa. As these ruins are in the Ute Reservation, the state and national government does not have any direct control over them. A ten years' lease has been obtained by the association from the Ute chiefs. The Secretary of the Interior has ratified the lease, and the association now has charge of the ruins. A toll road will be established, and the money received will go in part to pay for the rent which the Indians receive and also to keep the ruins from weathering and to protect them from vandals.

H. Causse has previously stated that contaminated waters have the property of restoring the color to Schiff's reagent and of giving an orange color with sodium para-diazo-benzeno-sulphonate. He now finds that pure waters will restore the color to hexamethylene rosaniline decolorized by sulphurous acid, while polluted waters give no color with the reagent. The reagent employed is hexamethyltriamidotriphenylcarbinol, known commercially as "violet crystals." It is employed in the form of a 1 per mille solution in water saturated with sulphurous acid. One hundred c.c. of the water to be tested is placed in a stoppered flask, and 1.5 c.c. of reagent is added. If the water be pure, a violet ring is formed on the surface, which gradually permeates the whole liquid. Another quantity of the water is heated to 35 to 40 deg. C. in a stoppered flask for two hours, and then cooled; this, treated as above, gives the violet reaction, but much more intensely if the water be pure.—Comptes Rend., 133, 171.

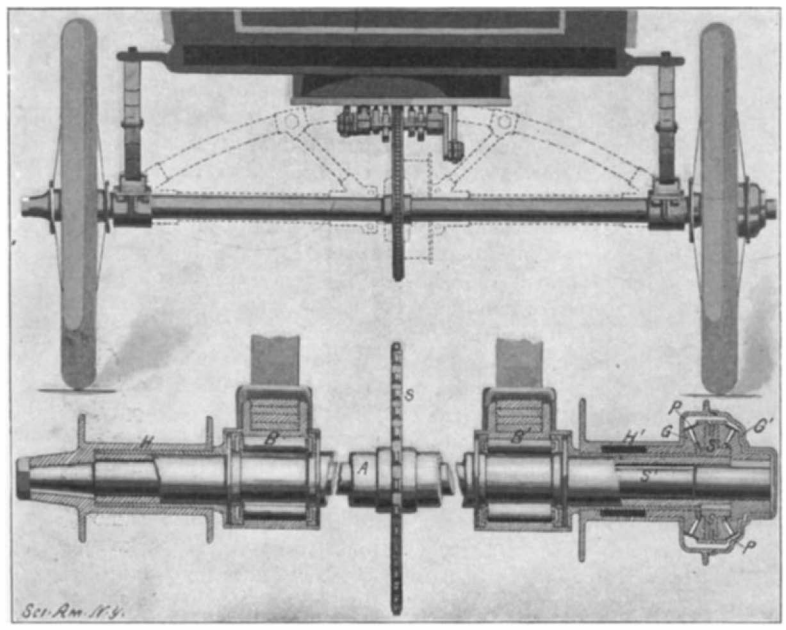
An important and enterprising scheme which will do much to foster commercial relations between Russia and England is to be made by a number of Russian agriculturists and dairy producers. At the present time the major portion of the butter imported into England comes from Denmark, but a large quantity is also supplied by Russia. The latter country is now to attempt to obtain the monopoly in this supply. A direct butter trade between various parts of Siberia and England is contemplated, and to accomplish it a number of landed Russian proprietors and traders from various parts of the country are going to visit England to study the requirements of the English nation with regard to this commodity and other dairy produce. The deputation will be under the direction of Prince Sherbatoff, president of the Moscow Agricultural Society. They will visit farms, dairies and cattle-breeding establishments in England, so as to become thoroughly familiar with the English method of farming and to carry out the same schemes as far as practicable in their own country. By this means the trade relations will be considerably improved between the two countries, and it will lead to a larger demand from Russia for English agricultural machinery.

A NEW DRIVING AXLE FOR AUTOMOBILES.

It is well known that the driving wheels of motor vehicles must be connected to the motor in such a way that they can revolve independently of each other, for the reason that when the vehicle turns a curve, or deviates from a straight line, the wheels mounted on the same axle turn at different speeds. Ordinarily, the driving wheels are mounted on the end of a rotating axle or shaft which is divided in its center so as to form two independent parts, these two parts being connected together and with the motor through what is called a differential or compensating gear—a mechanism consisting of two gears, one fast to each axle-end, and a number of loose pinions mounted on the part connected to the motor (usually a central gear or sprocket) and meshing with the gears. When a turning movement is applied to the central gear or sprocket, the pinions act with the same pressure on each gear. If the driving-wheels turn at an equal speed, these pinions remain stationary on their studs and act simply as driving-keys, turning the gears, axles and wheels together as if they were one piece. But should the speed of the driving wheels become unequal—as when the vehicle turns a curve—the pinions would rotate on their studs, with a balancing action on each gear wheel, as much as is necessary to take up the difference in the gears' speeds and drive the driving-wheels, to which they are connected by the axles, with equal force, irrespective of the difference in the speed at which they are turning. While this method of connecting the wheels together and to the motor permits their absolutely independent movement, the division of the axle into two parts weakens it greatly, and obviously necessitates the placing of two extra bearings near the compensating gear, besides introducing a very great difficulty—that of keeping these parts—each carrying a wheel and subject to the severe strains of the road as well as those from the motor—absolutely in line. The slightest diversion not only produces a great amount of friction, but causes the elements of the compensating gearing to slide in and out of pitch (perhaps to the extent of binding) during every revolution of the axle, wearing them out very much faster than they would otherwise wear under simply the compensating action of the parts. It is consequently necessary, with this compensating arrangement, to employ a very strong frame to hold the parts of the axle in line; this frame being, if well made, very expensive, owing to the great number of parts and accurate work required in its construction.

In the accompanying illustration is shown a new driving axle, which has been brought to our notice by Mr. A. E. Osborn, of 2048 Valentine Avenue, New York city, and which, it is claimed, will overcome these disadvantages by making the axle—while permitting the use of any type of compensating gear—solid from the outside of one hub to the outside of the other (the same as in horse-drawn vehicles). The axle, if so made, is not only simpler and stronger in itself, but does away with the weight and expense of the above-mentioned framing and the necessity for the central bearings, thereby eliminating their friction and leaving only the two outer bearings to need attention. The lower view of the annexed illustration shows a section, with the parts broken away, of one form of the driving axle, illustrating only one of the several modifications covered by the patent, while in the upper view is shown a rear elevation of the same applied to a vehicle. The neat appearance of the contrivance—there being nothing between the bearings, except a sprocket or other transmitting mechanism—is apparent, especially when compared with the frame and central compensating gear now used, as shown by the dotted lines.

As shown in the sectional view, the hollow driving axle, indicated by *A*, is mounted to rotate in the bearings, *B B*¹, fastened to the springs or framing of the vehicle, and is connected to the vehicle motor by a sprocket, *S*, and chain, as shown, or by any other suitable method. Through the axle a shaft, *S*¹, passes, fastened to the gear, *G*¹, of the compensating gearing at one end and to one of the wheel hubs, *H*¹, at the other, it serving simply to connect the gear and the hub together. The other element, *G*, of the gearing is attached to the other wheel hub, *H*,

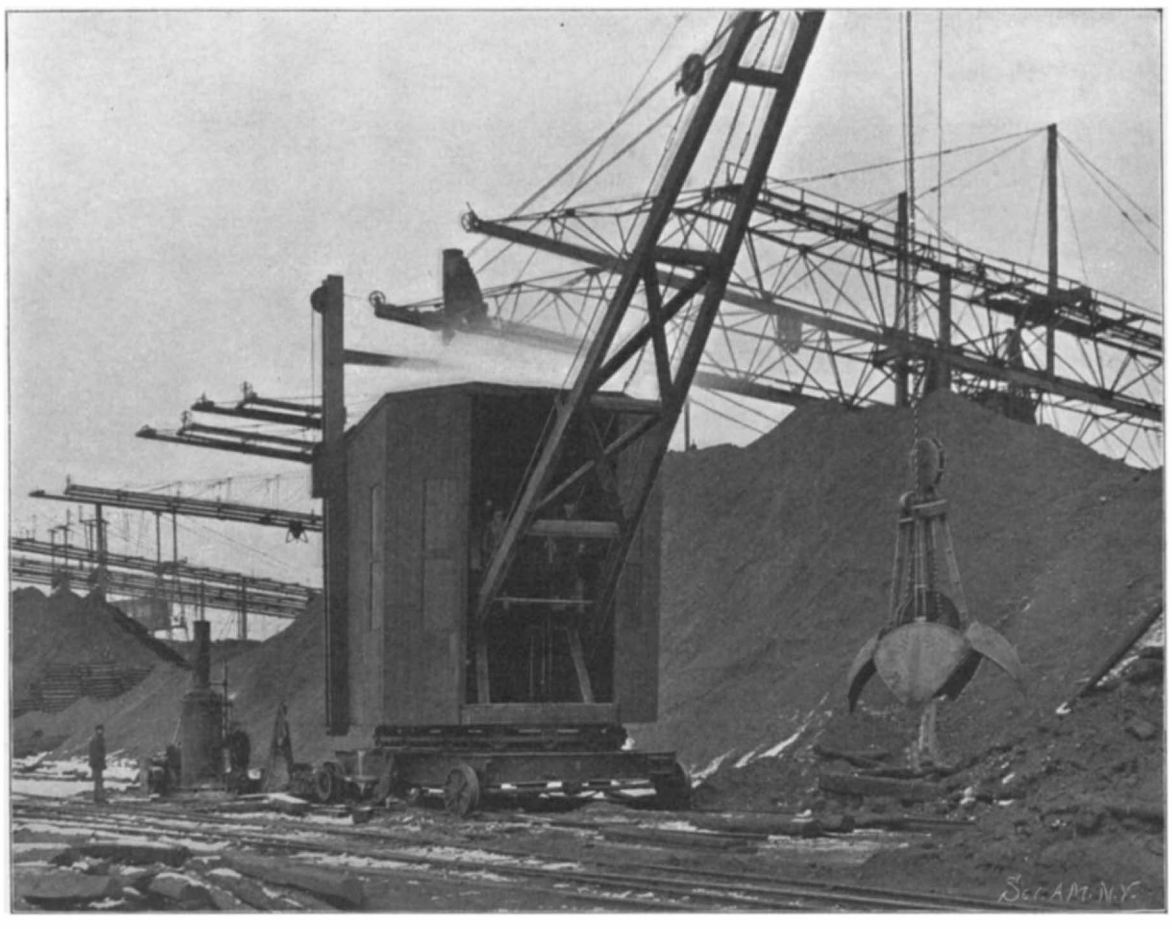


A NEW AUTOMOBILE DRIVING-AXLE.

mounted on the adjacent end of the axle and driving it directly.

Thus, as both wheels are, of course, free to turn on the ends of the axle, by driving the axle, the pinions, *P*, mounted on the studs, *S*¹, fastened to it, would drive both gears, *G G*¹, which, as they are connected independently to the wheels—one directly and the other through the shaft, *S*¹—would in turn drive them in the same manner as with the usual construction described. As the gearing is inside of one of the traction wheel hubs, it is more easily accessible than when it is placed in the usual position between the axle bearings; for, simply by removing the hub-core, it can be readily examined and oiled. Moreover, the adjustment of the axle-bearings does not affect the mesh of the compensating gears in any way.

Another important feature of this patent is that it covers the use of the spur types of compensating gears with any form of solid axle of the class described, although this type is not shown in the illustration, as the bevel type is more easily understood.



SELF-PROPELLING, AUTOMATIC GRAB BUCKET.

Paris is now erecting along its principal streets "*Phares de Secours.*" They are large lamp-posts provided with a box containing a stretcher, dressings for wounds and a telephone connecting with the nearest ambulance station. On the outside is a barometer and a letter-box.

SELF-PROPELLING AUTOMATIC GRAB BUCKET.

The handling of iron ore has produced some of the most ingenious and labor-saving machinery in the world. The demand for machinery of this type has been made and answered so successfully that the machinery itself has reacted favorably upon the ore-handling industry by multiplying tenfold the amount that can be handled in a given time, and also by greatly reducing the cost of handling. In the Scientific American we have, from time to time, illustrated the latest improvements in ore-handling machinery, and we now present an illustration of what is known as the Hayward Grab Bucket. This is one of the newer machines to be introduced in this class of work. It has made its appearance, and won its way into favor, at the great ore docks of the Carnegie Company, now owned by the United States Steel Company, at Conneaut Harbor. It is used for loading ore from the stock piles into the railroad cars. To enable it to be moved from place to place, it is mounted on a low truck, the wheels of which are driven by sprocket-and-chain gears, operated from a transverse shaft extending beneath the platform of the truck. The grab bucket is mounted centrally upon the truck and rotates upon a turntable, as shown in the engraving. The hoisting and turning engine is closed in by a wooden housing, so that the operators can work at all times protected from the weather. The bucket is what is known as the orange-peel pattern. It consists of four curved triangular steel plates, which are hinged together at their upper abutting corners, and are capable of being swung together until the lower edges meet and form a closed bucket, within which the material is retained. The bucket is raised and lowered by means of a wire cable running in a sheave carried on the top of the bucket. The opening and shutting of the sections of the bucket are accomplished by means of a chain which is worked from the platform of the machine. In operation, the bucket is allowed to fall by its own weight with the leaves open, as shown in our illustration. Its weight buries it in the stock pile; and, as it is lifted, the chain is wound in, bringing the sections of the bucket together and grasping a full load of the ore. The bucket is then raised by the wire cable, swung over the railroad car, and the chain is wound up, opening the leaves and releasing the load.

Persian Carpet Weaving.

A replica of the famous carpet from the mosque of Ardabil, which is now preserved in the South Kensington Museum, London, is being made at Tabreez, Persia, the center of the carpet-making industry of that country. The flowering and designing of this carpet are absolutely unique. A hand-painted design of the original has been furnished to the Persian weavers, and so skillfully is the work being carried out that it is stated by the English consul-general that when completed it will be equal in every respect to the original carpet, so faithfully is the work being reproduced, both with regard to coloring and detail. The carpet is being woven by boys ranging from eight to twelve years of age. They sit in serried rows before their looms. Their method of procedure is to pull the wool from a reel suspended above their heads in their left hands, and, with a flat knife provided with a crooked point in their right, dash the thread, with three movements, through the web strings, hook it into the desired knot, cut off the surplus ends, and start another knot. The work is carried out with such remarkable rapidity that it is almost impossible to follow the movements of the weaver. Before setting to work, the weavers closely study the painted design which they have to reproduce, and then depend entirely upon their memories to enable the work to be completed. Their memories are so reliable that it is very seldom they will refer back to the painted design. When

working upon a complicated pattern, the foreman of the loom—a boy about fourteen years of age—walks up and down, calling out, in a curious monotone, the number of stitches and the colors of the threads to be used. The Persian rugs and carpets are made by hand throughout, and none but vegetable or natural dyes are employed. It is to this fact that the longevity and durability of the Persian rugs are attributable, especially in connection with the colorings.

HOUSE BOAT "LOUDOUN."

The illustrations of the house boat "Loudoun," designed by Lewis Nixon for his own use, show what can be accomplished in the way of providing a floating home by one who knows just what is needed.

The "Loudoun" is 130 feet over all, 17 feet beam, and draws 6 feet. She is of steel up to 4 feet above the water, and wood above this. There is an unbroken upper deck 110 feet long enclosed by a netting rail and covered over by double awnings, the lower one blue, to do away with the glare of the water on bright days. The steel hull is divided into six water-tight compartments.

The living quarters are forward, arranged something like an apartment on shore. There are four large sleeping rooms, two bath and toilet with hot and cold salt and fresh water, a commodious dressing room, a parlor, and a dining room.

Back of the dining room the pantry extends across the vessel, and is the dividing line from the crew's quarters. The engine is forward of the boiler, so as to keep the heat away from the owner's quarters. There are no air-ports in the staterooms, as windows are used throughout. The owner's stateroom has six windows and four doors opening into it.

The vessel is driven by a triple-expansion torpedo-boat engine, having cylinders 10, 15 and 25 inches by 15-inch stroke, steam being furnished by a Roberts boiler. The after end has the deadwood cut away, the shaft being supported by a strut, such excellent maneuvering power being thus obtained that the vessel will turn in her own length.

The crew have an after deck covered with a blue-lined awning, which is 12 by 17 feet. The galley and pantry are bright and well ventilated, and the floors of both are covered with white tiles.

There is a large dynamo supplying electricity for a number of specially-designed lights, a storage battery supplying light after the owner retires, thus avoiding noise or vibration.

The anchors are raised by a steam windlass.

The "Loudoun" has proved herself an excellent seaboat and makes frequent trips to Newport and points along the Sound. She was designed to take advantage of the water facilities of New York—the Staten Island kills, upper and lower bays, the Horseshoe, Gravesend Bay, the Hudson and the Sound.

Ten men are carried in the crew—a master, chief engineer, two firemen, a chef, messboy, two stewards and two deckhands.

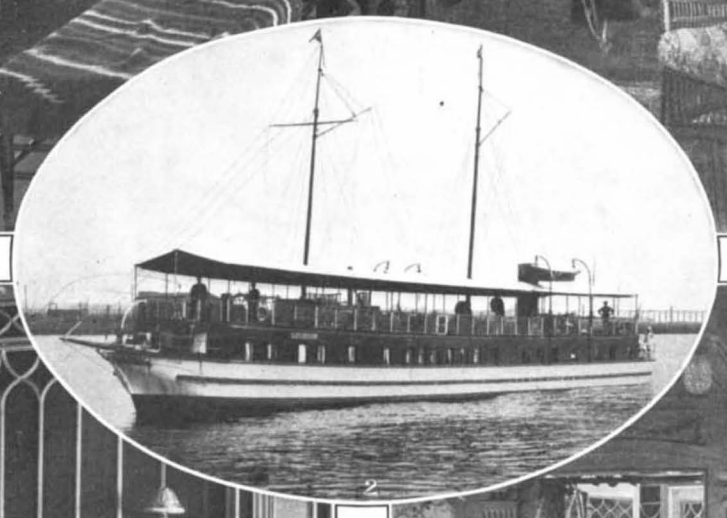
The "Loudoun" was named after the county in Virginia in which Mr. Nixon was born.

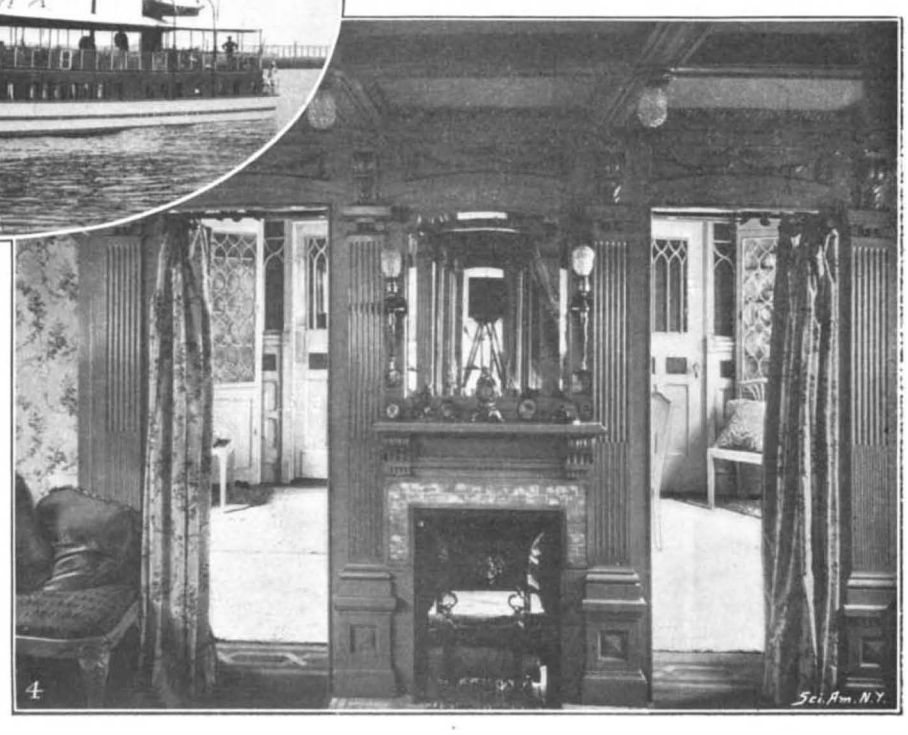
While nominally of 10 knots speed, the "Loudoun" often distances boats claiming a much higher rate of speed.

She can carry 14 tons of coal, and uses, in ordinary cruising, about a ton and a half a day. The tanks contain 15 gallons of water.

A NEW BOOK LAMP.

An exposition dealing with the prevention of seasickness is being held at Ostend, Belgium, and a large variety of appliances, remedies, etc., are exhibited.





1. Deck View. 2. Under Way. 3. Dining Room. 4. Parlor.

THE HOUSE BOAT "LOUDOUN."—LENGTH, 130 FEET. BEAM, 17 FEET. DRAFT, 6 FEET. SPEED, 10 KNOTS.

AN ADJUSTABLE ELECTRIC BOOK LAMP.

Our illustration shows a miniature portable electric lamp supported on a series of light, flexible metal links, held in whatever position they are placed by the friction of the connecting pins at the joints, and having at one end a spring clamp sufficiently large to slide over a book cover or some other thin article for a support. From the lamp attached to the opposite end run two wires to a small dry or storage battery, which may be carried in one's outside pocket or placed upon an adjoining table, or in the lap of the person reading. In the case of a newspaper, the clamp may be adjusted to the forefinger of one hand and the light of the lamp projected upon such portion of the paper it is desired to read, both hands holding the paper. The small reflector throws the light onto the book or paper and screens it from the eye. The wires are connected to the battery by the usual thumb-screws, or by simply slightly screwing or unscrewing the small lamp bulb; this latter plan is much quicker and easier.

The convenience of this lamp is self-evident, particularly so in warm weather, when reading in the house is uncomfortable; lawns and piazzas may be then resorted to without fear of the light being blown out by the wind. It is also useful for amateur photographers in supplying a ready light for changing plates or developing, and for travelers, in cars, boats or hotels. Nurses find it convenient for use in darkened rooms. It can also be used with advantage in many other ways.

Where the electric current can be had, special sockets or connections are provided, so that the lamp can be used without the battery. Duplicate batteries are supplied, which can be connected as soon as one gives out, or storage batteries can be easily recharged. We are informed that this novel lamp device has recently been introduced by the Portable Electric House Lamp Company, at 10 Cortlandt Street, New York.

Communication with Thibet.

An interesting endeavor is being made by a syndicate to establish trade communication with Thibet. Under existing circumstances, commercial relations with this seclusive country are almost impossible, owing to the lack of transportation facilities of any description. As a solution of the difficulty, private enterprise is suggesting the construction of a rope aerial tramway from the summit of the Jalep Pass to the railway in the plains, and already a section of the country has been surveyed. The line will probably be carried on to Yatung, a distance of six miles by trail, but which is only three miles as the crow flies. The ropeway, when completed, will be forty miles in length, and will constitute a record in this means of transit. The engineering obstacles that have to be surmounted are numerous, but the syndicate are confident of success. If completed, it will completely metamorphose trade in Thibet. The main idea is to find a market in that country for the Indian tea. Owing to the close

proximity of the tea gardens and the cheap means of transit promised over this ropeway, Indian tea planters will be able to produce very cheap bricks. But other difficulties present themselves, which will serve to militate against the realization of such a scheme. Importing tea is tampering with the coinage, since it is said to be a government monopoly, and is used in lieu of money payments. The various kinds of bricks are generally regarded as legal tenders. It is considered, however, that once the Thibetans are persuaded that the importation of tea is to their interest, they will purchase it, and all other difficulties will disappear. The people of that country will buy anything that is cheap. Taste is a matter of secondary importance to them. In making or brewing tea, these people mix the leaves with a quantity of butter, which greatly improves it; soda, to extract the color from the leaves and sticks; salt, sprinkled in according to taste, and the whole concoction is then boiled, churned, and served, and on a cold day is stated to be extremely refreshing.

THE CROTON DAM FOR THE WATER SUPPLY OF NEW YORK CITY.

Since our last notice of the construction of the Croton Dam this important work has been carried along to a point which enables one to get a very fair idea from photographs of its imposing proportions. The main masonry portion of the structure has been carried up to an average height of about 140 feet above the original bed of the river, and toward the southern end the top course of masonry has reached the level of the bottom of the series of arches upon which the overhanging roadway will be carried, this level being about 18 feet below the parapet.

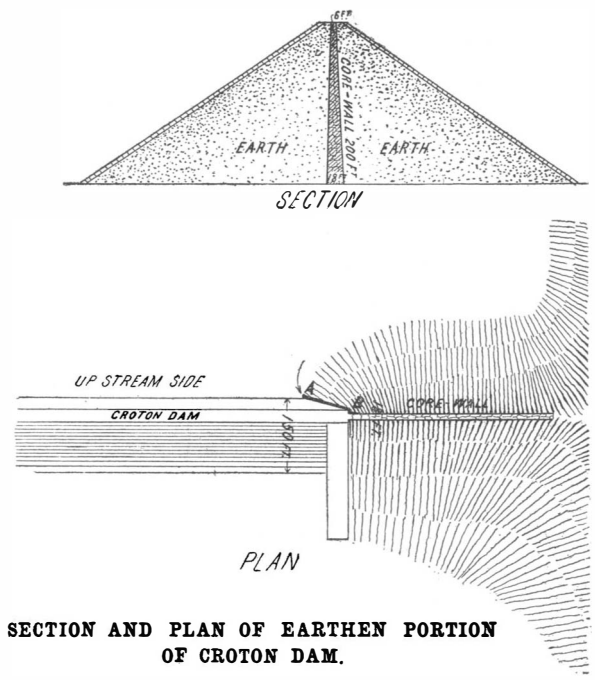
The Croton watershed, which lies 35 miles north of New York, has a catchment area of 362 miles, an average yearly rainfall of 46 inches, and an average yearly flow of 135,400,000,000 gallons. The present water supply of New York is conveyed from the old Croton Reservoir by two conduits known as the old and the new aqueducts. This reservoir, which lies some 6 miles from the mouth of the Croton River, has a capacity of 1,000,000,000 gallons. It was built half a century ago, and although it sufficed for the population of 350,000 of that day, it has for many years proved inadequate to the needs of the rapidly growing metropolis.

The new Croton Dam, which forms the subject of our illustrations, is being built across the Croton Valley at a point 3¼ miles below the old dam. The great reservoir which it will form will extend some 15 miles up the Croton Valley and will include the old Croton Reservoir. Since the completion of the latter several additional storage basins and smaller reservoirs have been constructed in the various valleys of the Croton watershed, and the contents of these, combined with that of the new reservoir which is now approaching completion, will give to New York city a total water supply of 75,000,000,000 gallons.

The great dam consists of three portions. The first 400 feet on the southern side of the valley is an earth dam with a thin, interior, masonry core wall; then follows the masonry dam which is 650 feet in length and extends to within 200 feet of the northern side of the valley, where the dam swings around in a broad curve and extends up the valley parallel to the hillside for a distance of 1,000 feet, finally turning into a junction with the natural rock of the bluff. This 1,000 feet forms the spillway and will be more than sufficient to take care of the greatest possible floods and cloudbursts of the watershed.

The construction of the dam necessitated an enormous amount of excavation, before rock bottom of a sufficiently firm and homogeneous character to support a structure of this size could be found. The huge trench was carried down to a maximum depth of 131 feet below the original bed of the river, the width of the trench at the lowest point being about 250 feet. The work of excavating was commenced in 1892 and completed in 1896, and during this period 1,100,000 cubic yards of material was removed. The cross-section of the masonry dam shows the upstream face to be approximately vertical, the down-stream face having a slope of about 50 degrees. As fast as the masonry was built in place, the excavated material was refilled until the original level of the bed of the river was reached, and at the present time about 134 feet, or two-thirds of the masonry, is buried out of sight. When the dam is completed to its full height, it will rise 160 feet above the old bed of the river, or practically 300 feet above the lowest foundation course.

Two hundred feet from the north cliff is located the gatehouse, in which are three 48-inch pipes, through which the Croton River will flow during the completion of the dam. After its completion they will be used in emptying the reservoir for purposes of inspection. As will be seen from our illustrations, this gatehouse is located at the southern end of the spillway, which is carried around through an angle of 90 degrees,



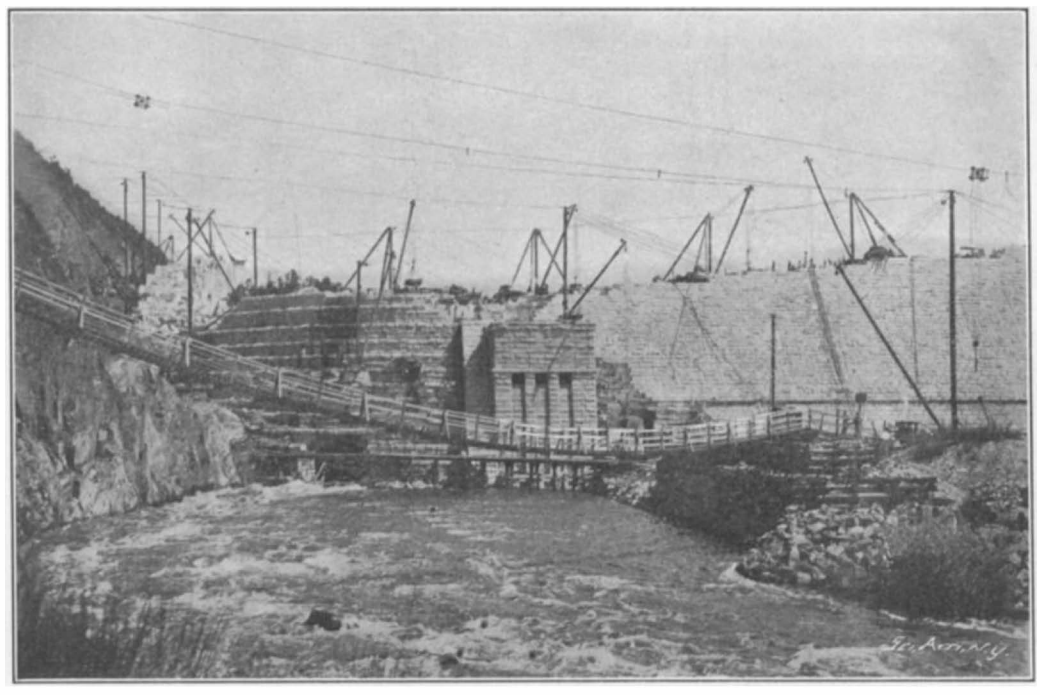
SECTION AND PLAN OF EARTHEN PORTION OF CROTON DAM.

until it is approximately parallel with the northern slope of the valley. The exterior face of the spillway is formed in a series of deep steps, with a rise of 8 feet, and over these steps the surplus water will flow during heavy freshets. The accompanying illustration is taken from the artificial channel which was formed along the northern side of the valley for the purpose of conveying the Croton River past the dam. An arched culvert has been built at the river level for the passage of water during the construction of the spillway.

We have already alluded to the fact that the southerly 400 feet of the Croton Dam is built on an entirely different system from the remaining portion. It consists of an interior core wall 18 feet in thickness at the base and tapering to 6 feet at the top, backed on both the upstream and downstream sides by a filling of earth with a slope in each case of 2 to 1. As will be seen from the accompanying plan there is no gradual merging of the masonry into the earth dam, but the change from one to the other is extremely abrupt, the masonry narrowing suddenly at the base from 150 feet to 18 feet. The masonry dam is homogeneous throughout. By virtue of its great mass, the careful selection of the materials which have been built into it, and the thorough bonding of the masonry, this portion is practically a monolithic structure. Its failure could only take place by its sliding forward, or by its being bodily overturned about its toe. The stability of the earth and core-wall portion of the dam is dependent upon its mass and the impermeability of the core wall. The earth dam, being built up in layers and each layer carefully rolled, is supposed to be impervious to water, the masonry diaphragm being introduced merely to make certainty sure. So long as the great mass of the earth dam is dry, its stability is certain, its great weight being sufficient to prevent its sliding bodily forward under the horizontal component of the pressure of the water. The very existence of the core wall, however, is an admission of the possibility of the saturation of the earth, and should this saturation on the upstream side take place, there would exist the following unfavorable conditions: the total weight of the core wall per linear foot would be about 200 tons, while the horizontal water pressure resulting from the saturation of the earth on the upstream side would amount to 550 tons to the linear foot. So long as the wall remained intact and watertight, the downstream mass of earth might prove sufficient to hold the dam in place, but should, as is altogether likely, cracks develop in the wall and the water cut through, it is certain that this portion of the dam would eventually be carried bodily away.

Moreover, the danger of water getting in between the upstream bank and the upstream face of the core wall is greater than might appear at first sight; for it will be seen that the slope of the earth embankment at the point of juncture of the core wall and the main masonry dam is carried around in the form of a section of a cone and overlaps about 300 feet on the main structure. As the latter will have no settlement whatever, and the earth dam will be constantly settling during the first three or four years, there will be every opportunity offered for water to work in along the face of the masonry dam at *A B* and find a lodgment against the upstream face of the core wall.

These considerations have led the commissioners in charge of the construction, acting on the advice of their chief engineer, to appoint a board of experts to investigate the subject and determine whether, even at this late hour, it would not be better to remove the core wall altogether and continue the masonry dam entirely across the valley, thus providing a homogeneous structure from abutment to abutment. The change advocated may mean a delay of from nine to twelve months, and an added cost of about $500,000; but in view of the vast importance of the new reservoir, and the necessity of providing absolutely against any possible failure, and the water famine which would inevitably follow, it is to be hoped that this committee will report in favor of the proposed change.



VIEW LOOKING UP THE TEMPORARY CHANNEL, SHOWING SPILLWAY AND HEADGATE.

Liquid Oxygen for Aeronauts.

BY OUR ENGLISH CORRESPONDENT.

An apparatus for the purpose of supplying aeronauts with pure oxygen when poised at a high altitude where the extreme rarefaction of the air renders them liable to asphyxiation, has been devised by a Frenchman, M. L. Cailletet. When aeronauts experience the nausea arising from rarefied air, they have recourse to the oxygen bag by placing the tube in their mouth. M. Cailletet considers this unnatural, since we are accustomed from birth to breathe through the nose, and he contends that when inhaling oxygen through the mouth it does not accomplish its object. His device for solving this difficulty consists of a double glass bottle containing liquid oxygen, and closed by a stopper through which two tubes pass. One of the tubes terminates above the surface of the oxygen, and it is provided on the exterior with a rubber weight, by means of which it is able to exercise atmospheric pressure on the liquefied oxygen. The other tube is made of lead and reaches to the bottom of the oxygen. The upper end of this second tube is connected with a vaporizer, comprising a very small boiler constructed of seven copper tubes communicating with each other. Owing to copper being a good heat conductor, the liquid oxygen, through the action of the rubber weight, is transformed into gas, and passes into a rubber reservoir which is fixed in the car of the balloon. From this reservoir extends a flexible tube communicating with the respiratory apparatus, which consists of a small metal mask protected externally with velvet to protect it from the cold. This mask only covers the mouth and nose in much the same way as the Fleuss apparatus is attached to the diver's face, being maintained in position by rubber bands. The gaseous oxygen in the reservoir is conveyed through the flexible tube to this mask and the aeronaut is enabled to breathe as comfortably as if he were inhaling the ordinary atmosphere.

A telephone cable has been laid through the Gothard tunnel.

Correspondence.

Small Ice Plant Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

You kindly published in the "Business and Personal Want" department an inquiry from me in regard to a small "family" or "kitchen" ice plant. But I have had no replies from it, and suppose there is nothing made for the purpose, though I noticed once, a year or more ago, that a patent had been granted for such kind of apparatus.

Perhaps if you would publish the inclosed paragraph, it might prompt some inventors to turn their attention to this field of useful work, and ultimately lead to the demand being supplied.

It might be remarked that the desired ice plant should be not too cumbersome or elaborate, and that it should be easily operated.

I want such a plant for a place I have in Florida, and I have noticed several inquiries for the same thing in your "Personal Want" department.

MARCUS R. ROGERS.

72 Dawes St., Springfield, Mass.

A Letter from Lick Observatory.

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN for August 31, 1901, contains the statement that the components of Capella "have actually been seen separately with the great telescope of the Greenwich Observatory and have been followed through more than a complete revolution." The statement is also made that "the shortest double-star period previously known is over 11 years—about 40 times that of Capella."

If the Greenwich observations of Capella are correct, they are of great interest, as is pointed out in your article, but, in view of the fact that this star has been carefully examined by experienced observers under favorable conditions, with more powerful telescopes than that at Greenwich, without obtaining any evidence of the star's being telescopically double, it would seem that the acceptance of the Greenwich measures should be held in abeyance. The Yerkes, the Lick, the Meudon, the Pulkowa, and the Nice telescopes are larger than that at Greenwich; those at Vienna, Washington, Cambridge (England), Flagstaff, and Princeton are nearly its equal in power. If the Greenwich observations are correct, it ought to be possible to confirm them with any of these instruments. I have not heard of its being done, and the great interest in the star as forming a possible connecting link between the spectroscopic and visual binaries would no doubt lead to the early announcement of the confirmation, were it accomplished by any one of them.

The spectroscopic observations furnish the dates when the two components of Capella have their maximum apparent separation. At about these dates, on several occasions, I have examined Capella under very favorable atmospheric conditions with the large refractor of the Lick Observatory without obtaining any evidence of its being visually a double star. Profs. Aitken and Perrine have also examined it, with the same instrument and with the same result.

Last year I published an investigation of the orbit of Delta Equulei, showing that its periodic time is probably not far from 5.7 years, instead of 11.45 years, which had previously been accepted and which is unquestionably erroneous. The spectroscopic observations of this star with the Mills spectrograph of the Lick Observatory by Director Campbell and Mr. Wright are of special interest, since these observations show that Delta Equulei is a spectroscopic, as well as a visual binary. The spectrograms secured in 1900 show no doubling of the lines due to the two components, but all of those obtained in 1901 do show a broadening or doubling of the lines, indicating a relative velocity of the two components of about 33 kilometers per second. W. J. HUSSEY.

Lick Observatory, University of California.

Arrangements have been concluded for the German transatlantic liners to make Dover a port of call. Negotiations have been in progress for some time past with the steamship companies' authorities at Dover and those who are responsible for the scheme of converting Berehaven, in Ireland, into a transatlantic port. The deep water harbor at Dover, which has a depth of 40 feet at low water spring tides, will be utilized for this purpose. A new masonry pier 3,000 feet in length and inclosing 75 acres will be completed in the course of a few weeks, and will afford excellent berthing accommodation for ocean liners. By this means the German vessels will call at Berehaven and then at Dover, thus saving several hours on the journey. It is also under consideration to land all passengers for France at Dover, then transporting them by the ordinary cross channel steamer to Calais, thence to Paris, by which means several hours would be saved.

Electrical Notes.

Lieut.-Col. Samuel Reber, U. S. A., has developed a system of wireless telegraphy which is said to give excellent results, and it is also said that it does not infringe upon the Marconi patents. It is now in use between Alcatraz Island and the Presidio, San Francisco.

Vibration caused by the underground electric road has injured the tower of St. Mary-le-Bow on Cheapside, London, a famous church built by Sir Christopher Wren. The company has agreed to pay $5,000 in order that the tower might be straightened. It is now 23 inches out of perpendicular.

A proposition to secure an appropriation from the New York Legislature to establish a school of electricity at Schenectady in connection with Union College was defeated. The General Electric Company has agreed to give $12,500, provided that the same amount is obtained from other sources.

Very little work has been done on the direct-current Nernst lamp, as it is not considered wise to go in for small candle powers. At the present time 300 hours is the life of a direct-current glower. The Nernst lamp will probably be a competitor of the arc rather than the incandescent lamp.

The Brooklyn Rapid Transit Company is about to build emergency stations for repair wagons in various parts of the city. A crew of five men will remain in the stations at all times, and, as in fire stations, the men will descend by means of a brass sliding pole, or, to be more accurate, a brass tube.

In St. Louis the nut-cracking industry gives employment to a considerable number of persons, there being three plants in the city. The nut-crackers are driven by electricity, each nut being fed individually into the crusher. After the shells are cracked the nuts are winnowed by an air blast and the meat is picked from the crushed shells by hand, women and girls being employed for this part of the work.

It is the intention of the British Admiralty to install the Marconi system of wireless telegraphy on Cape Race, Newfoundland, in order that the British Royal Yacht "Ophir," carrying the Duke and Duchess of Cornwall and York, may be communicated with when it approaches the Newfoundland coast in October, the idea being to prevent all possibility of an accident during the season when fogs are apt to be very plentiful.

The St. Louis Transit Company, during the period of excessive heat, gave free transportation to children ten years of age and under and one member of the family where the parents were unable to pay for transportation. They were permitted to ride free on the cars to the principal parks and recreation grounds in the vicinity on presentation to the conductor of a doctor's certificate saying that the child would be benefited by an outing.

A correspondent in Paris suggests, in view of the fact that electricity is produced at very low rates in Norway and Sweden by utilizing hydraulic power, that in Iceland electricity may be produced quite as cheaply, if not cheaper, so that the electric heating of houses and buildings could be accomplished much cheaper than by coal, which costs $9.50 to $11 a ton. The hydraulic power available is very large, and owing to the prevailing winds, windmills could also be utilized. Of course, Iceland is sparsely inhabited, so that it would hardly pay to install an electric system except in a few localities. With this vast water power available it seems as though it would pay certain chemical industries to locate there.

A new process of preparing wood for building is in use in Austria. Green wood is placed in a large wooden trough whose bottom is covered with a lead plate. This is connected with the positive pole of a battery. Covering the wood is a second lead plate which forms the negative pole. The wood is then subjected to a bath in a solution composed of 10 per cent rosin and 75 per cent soda. Under the influence of the electric current the sap is drawn out of the wood and rises to the surface, the solution being absorbed by the wood. The operation requires from five to eight hours. The treated wood is allowed to dry for about two weeks, when it is ready for use. The drying can be hastened artificially if desired.

A new electric lamp has been devised by Dr. Sophus Bang, the manager of the laboratory of Prof. Finsen, the inventor of the lupus light cure, specially adapted for utilization in connection with the cure. In this lamp the inventor has substituted metal in lieu of the carbon poles, and although a very feeble light is emitted, it is stated to be exceptionally rich in the chemical rays. By this means the therapeutic properties of the light are increased tenfold. Consequently a patient who at present has to submit to an operation lasting one hour and a quarter will only require approximately ten minutes' treatment at a time. The cost of the lamp also is so low that it will be possible for every doctor to possess one, since it can be fitted to an ordinary electric light installation.

Automobile News.

Fifty thousand dollars have been appropriated to provide motor cars for use in the approaching maneuvers of the German army.

We have received a copy of The Auto Era, published monthly by the Winton Motor Carriage Company, of Cleveland, O. It is composed of a number of brief notes on live automobile topics, and is illustrated by many engravings, including some showing an automobile among the quicksand deserts of Nevada. It is edited by Charles B. Shanks.

The automobile has brought many new words into use. The correct word for a private collection of automobiles, equivalent to "stable," seems to afford considerable difficulty. "Motorbarn," "motorome," "motorden," "motorium," "motorshed" and "motable" have all been suggested. The French term "garage" would be a good one if it was not used for designating a place simply for storing and repairing automobiles.

A postmaster of a Western city recently desired to experiment with mail collection by automobiles. A local manufacturer placed a machine at his disposal and the collector was started out with it. When the first box was reached the collector remembered that there was a time schedule for the collection of mail, and as this was the case with all the boxes the automobile showed no gain in speed over the ordinary horse and cart.

The consent of the local municipalities having been obtained by the Pan-American authorities for the holding of a 100-mile road race between Buffalo and Erie, the governors of the Automobile Club of America have decided to hold the annual sweepstakes over that course, September 19, 1901, as originally planned. The governors have also decided to hold a week of sports in the Stadium during the week September 16-21 inclusive, including the race for the mile record.

The Grand Duke Nicolas Mikhaïlovitch is one of the first to make the passage across the Caucasus range to Batoum. He reached the latter town on the first of August on a Mors machine of 10 horse power, which he has been using for some time in the Caucasus region. According to a telegram which he sent to the Mors establishment at Paris, he had just been the first, with Leon Renhold, to cross the Goder Pass, which is at an altitude of 7,000 feet, on the route from Borjom to Batoum. They made the trip from one place to the other, a distance of 150 miles, in 11 hours, and the Duke is highly pleased with his performance. The Goder Pass is in the western part of the Caucasus region. Borjom is a small town in the Kars province, to the south of the Caucasus and near the Persian frontier.

The Fourth Annual Automobile and Cycle Show is to be held at Paris from the 10th to the 25th of December, and will doubtless prove as great a success as last year's show. It is organized by the Automobile Club of France, together with the Chambre Syndicale de l'Automobile and similar associations of manufacturers. It will be held, as before, in the Grand Palais of the Champs-Elysées, which affords ample space and a good light. The list of rules has just been published. Automobiles, moto-cycles, and mechanical traction vehicles form the first class, and cycles of all systems, the second. Then come materials of construction, tires and pneumatics, detached pieces, motors and accumulators, the classes relating to navigation (automobile boats), aerostatics, sports and touring, carriage work, costumes and equipments, inventions, bibliography and photography. Demands for space should be addressed to the Commissariat Générale de l'Exposition, 6 Place de la Concorde, before the 10th of October. Special arrangements have been made as to insurance and the handling of inflammable material. The Commission is taking measures to have all the objects imported free of duty, provided they are taken back after the Exposition.

Progress on the Uganda Railway.

Work upon the Uganda railroad is proceeding rapidly. When completed it will be 583 miles in length. By the end of October of this year the railroad will have reached the shore of Lake Victoria; the earthwork about March, 1902, and the American viaducts a few months later. The cost of completing and equipping the road is estimated to amount to about $26,000,000. At first the paying prospects of the road do not appear encouraging, as the working estimates prove that even with one train each way daily the expenditure will total about $1,000,000, while the receipts, it is anticipated, will not attain more than $500,000. The government will, therefore, have to pay about $500,000 on the year's working for 1902-1903, and a similar decreasing sum each year until about 1910, after the lapse of which time it is expected that a small return will be gained upon the expended capital.

Mica has been found a few miles from Yarmouth, Nova Scotia, in considerable quantities.

IMPROVED HYDROGRAPHIC INSTRUMENTS.

A set of hydrographic chart-engraving machines, intended for use in the Hydrographic Office in the Imperial Japanese Navy, identical with those made by Queen & Co. for the United States Hydrographic Office and the United States Coast Survey, have just been completed at Philadelphia. The instruments are the invention of Vincent Le Comte Ourdan, who was for nineteen years engraver in the United States Hydrographic Office, where, by his inventive and executive ability, he created the Section of Mechanical Engraving, of which he was chief until his recent resignation for the purpose of going to Japan to deliver and install a complete set of the chart-engraving machines.

There are now in use in the United States Hydrographic Office two sets of these machines, and while they do not engrave quite one-half of the entire chart, they have, according to the official report of the Hydrographic Office, trebled the output of charts. The machines, of which there are six, consist of a sounding-engraving machine, a combination of tinting and border-engraving machine, a border subdividing machine, a border and scale-shading machine (which also engraves the United States Hydrographic Office symbol of mud bottom), a compass-engraving and lettering machine, and a multi-point divider. Our illustrations represent the sounding machine, the compass machine, and the lettering machine.

The sounding machine is 10 feet in length by 4 feet 6 inches in width; its great length permits the original drawing and the plate to be engraved to be placed side by side on the table. The positions of the soundings are transposed from the original drawing to the copper plate by means of a cross-head which travels north and south, carrying two carriages which travel east and west, each in an opposite direction to the other. The one overplaying the drawing carries a stationing-point, which is always in contact with the surface of the drawing; the other carries the engraving mechanism and a set of patterns, which are engraved on a circular disk mounted on top of said carriage. At the lower part of said carriage is a universal joint through which passes an engraving tool long enough to reach from the plate over the pattern disk.

The position of the sounding desired to be engraved is obtained by moving the cross-head north or south and the carriages east or west until the stationing-point is over the first figure of the sounding to be engraved. The pattern disk is then rotated until the proper numeral is brought to the index point directly in front. The engraving point, which is heavily weighted, is then lowered to the plate, and the upper end is made to follow the channel of the engraving pattern, thus cutting the numeral in the copper plate.

This operation is repeated until all of the soundings are engraved. The depths of the lines are regulated by the amount of weight on the engraving point.

The size of the figure engraved is regulated by raising or lowering the universal joint. To compensate for the shrinkage or expansion of the drawing, the stationing-point has a movement independent of the engraving point, and as the engraving point travels north and south or east and west, the stationing point is moved in the reverse direction by its independent movement, thus distributing the small error, due to shrinkage or expansion, over the entire chart so that at no one point is it noticeable.

The compass machine consists of an annular base, on which rotates a tool-carrier for engraving compass roses, and another tool-carrier for lettering the same. The base is oriented on the plate in proper position, and a true north compass consisting of a circle of 360 degree lines, and inside of that circle a circle of 128 lines representing the mariner's points. After this is engraved, the compass is set to the desired magnetic variation, when another degree circle and mariner's-point circle, both at the magnetic variation, are engraved inside of the true compass.

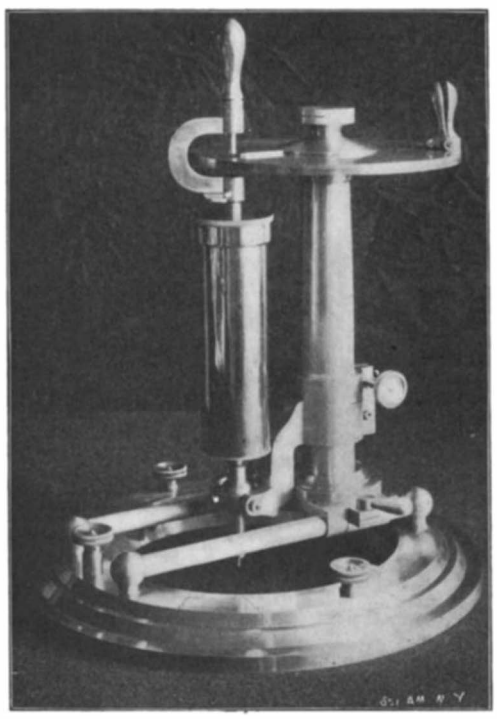
The compass engraving mechanism is then moved from the base, and the lettering mechanism substituted. This mechanism operates in exactly the same manner as the sounding machine, except that it only engraves in circles instead of straight lines, as in the case of the former.

Messrs. Queen & Co., Philadelphia, have been commissioned to supply a set of these machines to the German government, and expect to equip the hydrographic offices of the principal countries of the world with complete sets.

A popular woolen fabric much worn in England, a tweed, has caused a tuberculosis scare in England. It seems that it is made in little cabins by peasants, among whom consumption is very prevalent.

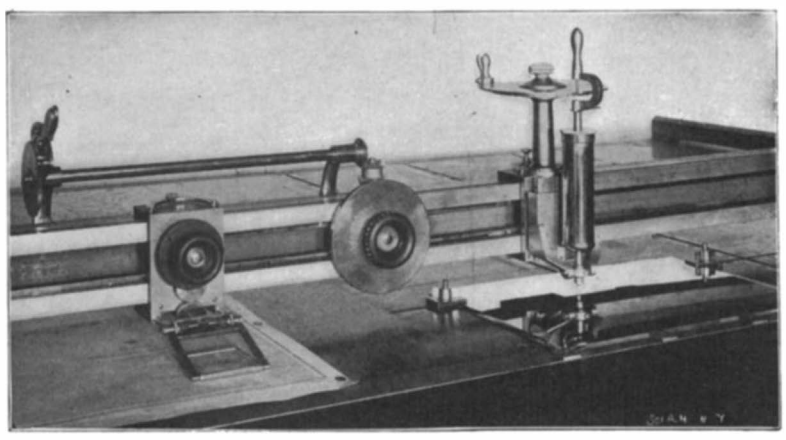
A New Plan for Protecting Trees Against Cold.

Mr. J. F. Tucker, of Brooksville, Fla., has devised a most ingenious apparatus for protecting trees or vegetation against the cold. He found by observation and experience that tender vegetation on the south shore of a river, lake or other body of water, usually escaped the blighting effect of frost, while similar vegetation on the north side had been badly hurt, and even killed. The orange groves in Florida, which have enjoyed

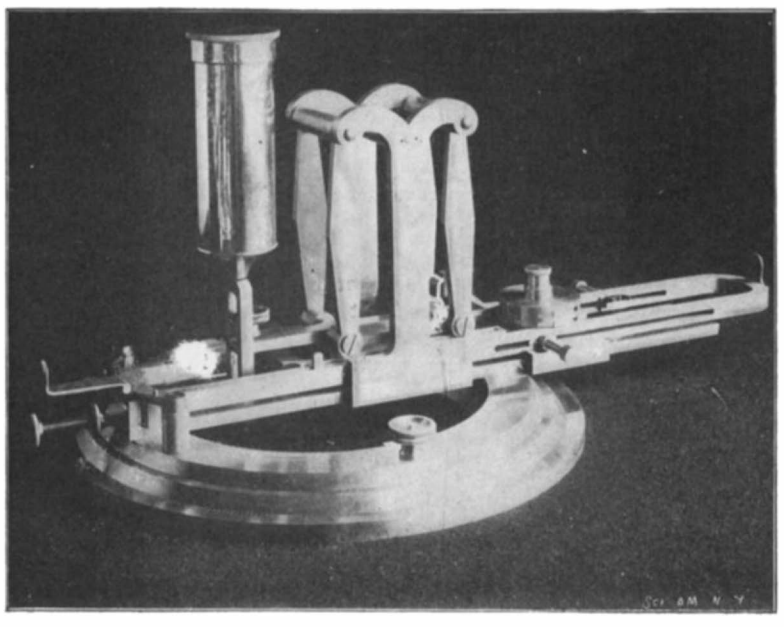


THE LETTERING MACHINE.

the greatest immunity from frost, have been, in nearly every case, protected by a body of water to the north or west of them, or, better still, both north and west, the directions from which the severest cold in Florida usually comes. In Florida the deep-water rivers and lakes are commonly fed by springs which contribute to the heat treasured up from the long summer months, so that when a cold spell comes the air is brought in contact with the body of water at a relatively high temperature—say 66 to 70 deg. F. This contact of the cold, frosty or freezing atmosphere with this body of warm water causes a cloud of fog or vapor, sometimes quite dense, to rise from the surface of the lake or river, and completely envelop the locality south and east of it, thus securing immunity to orange groves or vegetable gardens that may happen to be there, and groves are so located with the specific purpose of securing the protection assured by such conditions. This vapor by condensation makes sensible the latent heat supplying the favored locality with both heat and moisture and raising the temperature to such a degree as to give more or less immunity from damage by frost or freezing. According to a bulletin published by the Weather Bureau, the heat given off by the condensing of vapor is enormous. The condensation of enough vapor to make one pint of water will evolve enough heat to raise more than five pints of water from the freezing to the boiling point. Mr. Tucker's invention proceeds upon these principles, and it comprises means for making an artificial fog in the orchard or over the ground to be protected, in which means he employs, as leading elements, one or more artesian wells for supplying water, pipes for distributing the water through the grounds, heat appliances for warming the water, pumps for forcing it to its destination, compressed-air appliances and numerous spray-nozzles distributed through the orchard for spraying the warm water and converting it into a protecting blanket of vapor, in connection with other details. The essentials in his process are heat and moisture, applied in such a way as to make sensible the latent heat as an adjunct to the heat he actually applies. For water he favors artesian wells, as they are usually of a high degree of temperature and remain unchanged by the cold of winter.



REAR VIEW OF SOUNDING-MACHINE.



THE COMPASS MACHINE.

In the absence of wells, he seeks the warmest water he can find in the deepest parts of rivers, lakes, etc. In Florida he has found artesian and other deep wells to range from 72 to 84 deg. F., and he considers that 65 to 70 degrees can be depended upon for the deep water of rivers and lakes, his object being in all cases to obtain a water naturally the warmest. His experiments have been made with the natural water alone, and he believes that where the temperature of the well runs high it will, for anything but the severest weather, be found sufficient; but, in order to make his system a protection against any cold that may come to the fruit belt, he utilizes the intense heat of compressed air, by means of which he believes he can raise the temperature of these arid warm wastes to 100 and 110 deg. or more. Mr. Tucker's device comprises a system of pipes with spray nozzles extending at close intervals and distributed throughout the entire field, a well or other source of water supply, pumps for energizing the water, and an air compressor discharging its air in a heated condition directly into the water for the triple purpose of promoting the flow of water, for heating the same, and for admixing a gaseous medium therewith to promote its atomizing at the discharge nozzles. The pipes running through the orchard are from 1 to 2 feet underground, and are connected with the spray-nozzles at suitable intervals. Valves serve to control the mains. For ordinary purposes two outer guard-lines will probably be sufficient, since nearly all Florida cold spells are accompanied by winds of considerable velocity, and these winds will sweep the vapor through the grove as it does the mist or fog that rises from a body of water to north or west of a grove, and he finds he can, by heating the water, bathe the grove in a hotter and moister atmosphere than is done by a lake or river. Cisterns are provided which are to be housed and tightly covered so as to hold the heat, in order that the water may be stored therein from one to three hours, with the air-pump working at full capacity in order to be sure of sufficient heat to overcome the severest cold that may ever occur in the orange section, thus making the grower perfectly secure. The apparatus can be arranged to be used for irrigation when desired, and one of the cisterns can be used for the preparation of the emulsion for treating the trees for scale and other insect enemies. When the hot compressed air issues from the ejector into the artesian well, it mingles with and is carried along by the water in its travel to the spray-nozzles. This not only insures the utilization of all of the units of heat in this air, but it also, when issuing at the spray-nozzles along with the water, forms an atomizing blast and produces a fine comminution of water and produces the physical characteristics of fog.

A New Vineyard Pest.

The vineyards of northern Portugal have been attacked by a new pest called the Maromba disease. Samples of the trees attacked have been sent to the Royal Gardens at Kew, London, for investigation, and the result of these examinations shows that the disease is caused by a fungus, the *Rosellinia necatrix*, which has the peculiar power of attacking the roots of almost every kind of plant with which its mycelium comes into contact. The remedy is an application of carbon bisulphide near the roots of the affected trees.

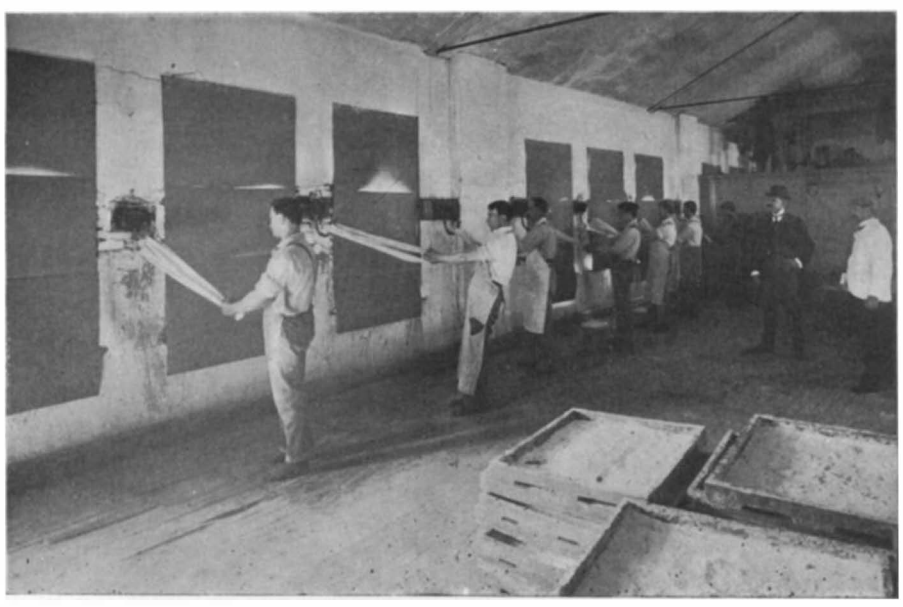
THE MANUFACTURE OF CARAMELS.

The confectionery industry in the United States is of the first magnitude, and vast quantities of all forms of this luxury are shipped abroad. Machinery now enters very extensively into the manufacture of confectionery of all kinds, and particularly in the manufacture of caramels, which are a favorite form of sweet. About 90 per cent of all the caramels made in this country come from Pennsylvania, from three factories which are operated by a single company. The books of one of these factories showed that 332,000,000 caramels were turned out last year, and it is approximately estimated that the output of the three factories amounted to 1,300,000,000 caramels. A large proportion of this amount was packed in small boxes and packages for sale on trains, etc.

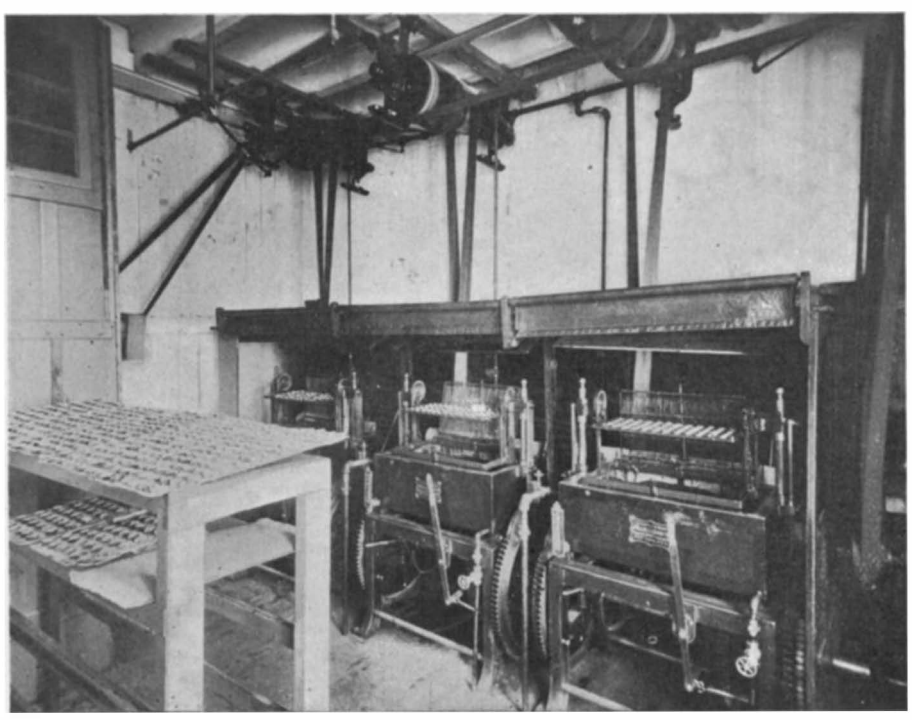
The principal ingredients which enter into the manufacture of caramels are sugar, glucose, milk and cream, chocolate, and such materials as walnuts, cocoanuts, etc. Cream is used only in the higher grade goods, condensed milk being used for the low and medium grades. In brief, the various processes in the course of manufacturing caramels may be described as cooking, sizing, cutting, wrapping, and packing. The photographs from which our illustrations were made were taken in the factory at York, Pa., where one of the large plants is advantageously located between two competing railroads. There are a number of buildings, the principal one being of brick, four stories in height. The railroad tracks lead directly to the factory doors, so that the raw material and the finished product can be received and shipped direct, with the smallest amount of handling. In the basement of the building are stored large quantities of sugar and glucose, and here, also, is the cream-separating and milk-condensing plant. The milk is received directly from the farms each morning, and the cream is separated by a De Laval separator. Part of the cream is retained for use in caramel-making, but the greater part of it is sent to a creamery, where it is made into the highest grade of butter; 30,000 quarts of milk are condensed daily in the condensing plant. After the cream has been separated from the milk the latter is condensed in a condensing pan where atmospheric pressure is removed and the percentage of water is reduced by boiling.

Wrapping and Packing Caramels.

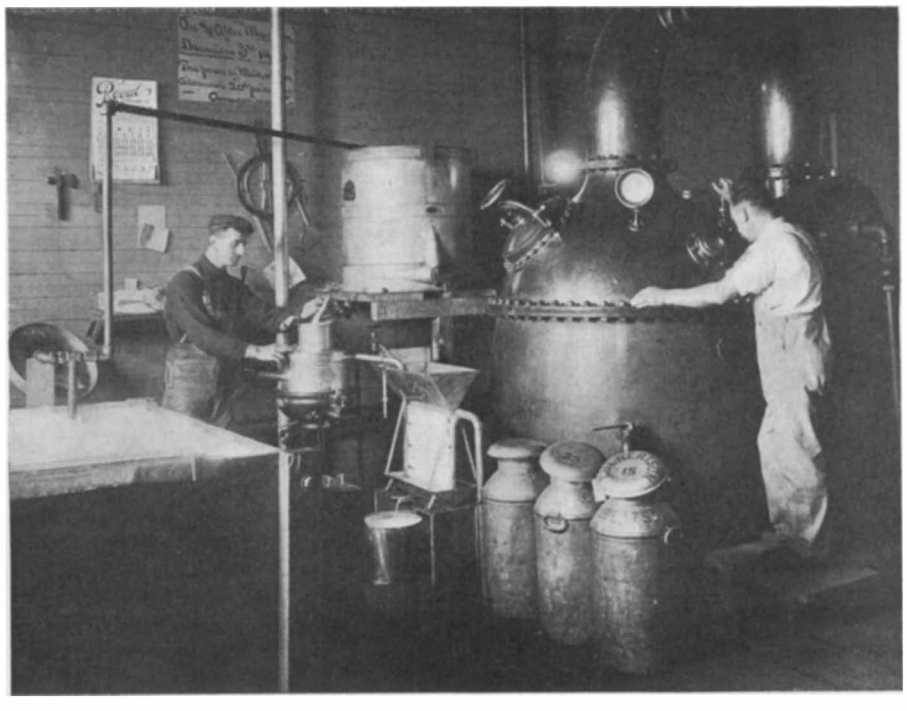
The glucose, sugar, syrup and condensed milk are forced through pipes to the top of the building, in order to reach the cooking room. When the glucose reaches its destination it is stored in a tank provided with a steam jacket to keep the contents thin. From this tank the glucose is distributed through the medium of other tanks to the cooking kettles, which we illustrate. There are twenty of these copper cooking kettles, provided with steam jackets. They hold from 75 to 200 pounds of the material. The other ingredients are mixed in the basement of the building, and when reduced to a liquid state they are forced to the cooking-room in the same manner as the glucose. The cooking process, which usually lasts about 30 minutes, varies in time according to the nature of the goods being produced. The contents of the kettles are stirred constantly by mechanical means, and they are nearly all of the tilting pattern. When the ingredients have become thoroughly mixed and cooked they form what is known as "caramel paste." The kettles are then tilted and their contents turned out into iron pans, shown at the rear of the kettles. The pans with their contents are then slid into the cooling room and the doors of the compartments are shut. The cooling room is connected with a refrigerating plant so that the caramel mixture in the shallow pans hardens in a very few minutes, when ordinarily one or two hours would be required if exposed to the air. Where large quantities of caramel-mixture are to be handled it will readily be seen that it is very necessary to have all the operations conducted so as to occupy a minimum of time. From the cooling room, the mixture, still in the pans, is taken to a cutting room, where the sizing and cutting operations are performed by machinery. The pans are adjusted so as to fit these machines. The sizing machine, which reduces the mixture to any thickness required, consists of rollers which act in the same way as the rolls in a mill. Each has two steel rollers, one smooth and the other grooved. The machine



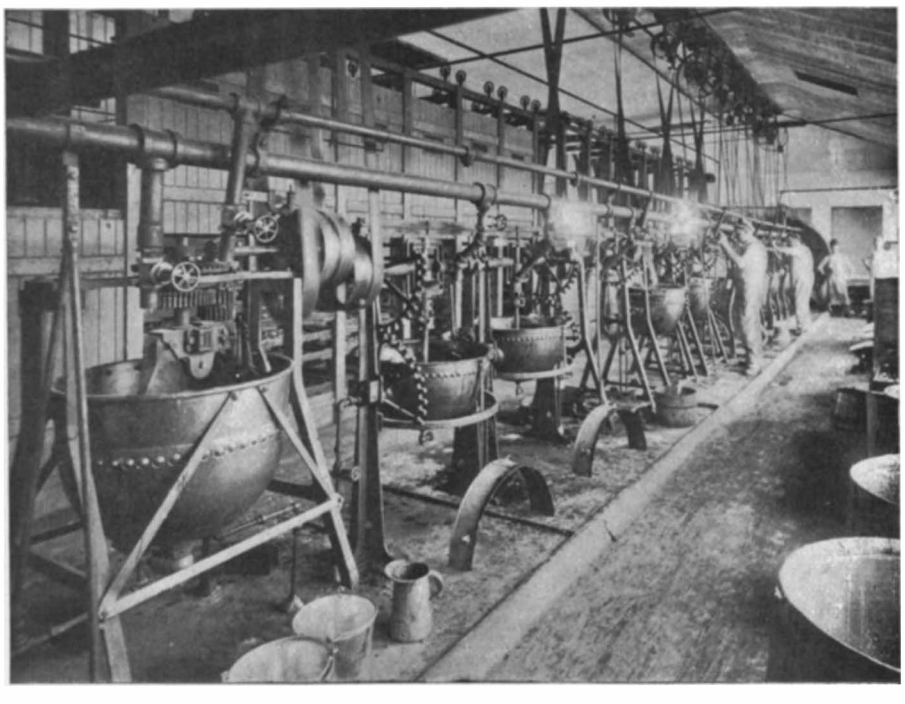
Pulling Room.



Chocolate Caramel Dipping Machine.



Condensing Milk and Separating Cream.



Cooking Room.

THE MANUFACTURE OF CARAMELS.

is adjustable so as to reduce the mixture to any thickness required. From the sizing machine the mixture, which has now been reduced to gage, is run through the cutting machine, which consists of a smooth roller at the bottom, and circular knives at the top. These knives revolve against the roller, cutting the material lengthwise. The operator then reverses the machine and the material is cut crosswise, making the familiar cubes which are known as "caramels." From the cutting machine the caramels go to the wrapping and packing room. Here the individual caramel is wrapped in wax paper and the goods are packed in boxes of from one to five pounds each. Small packages are also made up. Machines have been devised for automatically wrapping the caramels, but up to the present time hand wrapping is largely employed.

Our other illustrations are devoted to special forms of caramels, for there are many kinds, grades, and qualities. One of them shows the pulling room, where caramels are made without glucose, containing only sugar, milk and such coloring matter as enters into their composition. These are known to the trade as "pulled goods." They are light both in color and weight. Large masses of the candy are thrown over hooks secured to the wall, and the mixture is rapidly pulled until it is smooth and fibrous. In our illustrations the large trays in the foreground are filled with starch, which is used to prevent the candy from sticking to the hands. Another illustration shows the chocolate room, where certain varieties of caramels are coated with chocolate. After the caramels are cut they are placed on sheet-iron frames, each little cube in a compartment by itself. They are then lowered into a tank of liquid chocolate, and the tray and its carrier are then raised out; the excess of chocolate is removed and the drippings are allowed to go back into the tank. The coated caramels are then set aside to cool and afterward are sent to the wrapping room, where they are inspected by examiners and testers, whose duty it is to see that the weight and count of all caramels are correct and that the quality is up to the required standard.

Cocoanut enters largely into the manufacture of caramels, and in the busy season this plant consumes 5,000 cocoanuts in a single day, and has used 15,000 in two days. The shells are cracked by boys, and the cocoanut is removed and shredded by machinery. The shells make excellent fuel, and are used as well as coal under the boilers, but, strange to say, the one part of the cocoanut which goes to waste is the milk. Various experiments have been made in the hope of finding some use to which it could be put, but so far without success. The caramel company employs about 1,400 hands in this plant, and about three-quarters of this number are girls.

Latest Developments in Aerial Navigation.

Contemporaneous with M. Santos-Dumont's experiments to solve the perplexing problem of aerial flight several other inventors are designing vessels by which they hope to achieve the same object. The three most noteworthy attempts in this direction are being made by M. Henri Deutsch, the donor of the $20,000 prize, and two Englishmen named Mr. Buchanan, and Mr. T. Hugh Bastin, respectively.

In designing his vessel Mr. Deutsch has availed himself to a great extent of M. Santos-Dumont's design. The cradle is practically identical. The balloon is also very similar, only of far greater capacity than that of M. Santos-Dumont. The cradle measures 98½ feet in length, excelling the latter's machine by 38½ feet, while its weight is four times as great—440 pounds. The balloon is 197 feet in length, with a capacity of 2,000 cubic meters, as compared with 600. The motor is of 60 horse power, and weighs 880 pounds. The construction of the vessel is being pushed forward and the experimental trips will soon be undertaken.

The vessel invented by Mr. Buchanan is novel in many respects; in outward appearance it resembles an immense bird, after which it is in reality designed. It is 120 feet in length, with a beam of nearly 14 feet and weighs complete with motor attached, and all appliances, 23 hundredweight. The keel is constructed of yellow pine, and the body is entirely composed of bamboo covered with sailproof cloth made absolutely waterproof. This covering reduces the angles, gives the vessel a curved appearance, and considerably reduces the air resistance.

The engines are approximately of 14 horse power with four cylinders capable of imparting a velocity to the machine of 40 miles an hour. The most prominent characteristic of the vessel is the transverse grip propellers, placed on either side of the vessel like the wings of a bird. To insure the blades of the propellers obtaining a secure grip on the air they have been especially roughened, and by this means greater power will also be attained without increasing the power of the engines.

The rudder, which is strongly made of aluminium and is shaped like the tail of a shark, is so constructed that it will work from any angle as the steersman may desire. The engines and cabin are situated in the lower part of the ship, the upper part being inflated to assist in the buoyancy of the vessel and to increase its ascensional power to a certain extent.

The vessel can rise or descend at any angle or vertically without losing any of its buoyancy, and is perfectly rigid in every respect. All the screws are of brass and the bottom of the vessel is cased with sheet copper and bound with hoop iron.

Mr. Bastin, in his creation, has entirely eliminated the balloon and has produced an airship pure and simple. He bases his invention upon the means utilized by Nature for aerial propulsion, viz., the wings. He has produced mechanism which is capable of reproducing the requisite movements of a bird's wings. The latter can be fixed horizontally outstretched for soaring purposes, and the plane can also be varied to render upward or downward movements possible. Also, from this fixed position, the wings can be caused to vary in a graduated manner from a simple vibration up and down to the full amplitude or beat, and this movement can be maintained under any variety of plane.

Each wing is controlled separately, so that the beat can be varied for the purpose of procuring movement in a lateral direction, left or right. The body of the vessel entirely incloses the mechanism and gives ample space for crew and passengers. It is also so arranged that the entire weight is below the wings, thus insuring perfect equilibrium. Experiments with both of the English creations will be made in the course of a few weeks, when their merits or disadvantages will be adequately realized.

New Cæsium Compounds.

M. C. Chabrié, who has been experimenting with the metal cæsium, has lately succeeded in forming a new series of compounds. Among these are the sulphite, bisulphite, hyposulphite, etc. These results are described in a paper read before the Académie des Sciences.

Breaking Cocoanuts.

THE MANUFACTURE OF CARAMELS.

The first compound is the sulphite of cæsium. It is formed by taking 14 parts by weight of pure carbonate of cæsium (obtained from the mineral pollux), and dissolving it in 400 parts of boiling ethylic alcohol at 99 degrees strength. The solution thus obtained is divided into two equal parts. One of these is saturated with dry sulphurous acid gas by allowing a stream of the gas to pass through it for 3 hours; this produces a bisulphite, which is partly precipitated as a white powder. The whole, liquid and precipitate, is mixed with the remaining half of the original solution, and heated for 3 hours in a water bath. Afterward the alcohol is distilled off and the residue dried *in vacuo*. This residue is an anhydrous sulphite of cæsium, and appears as a white and crystalline mass, soluble in its own weight of boiling water. The author points out that by using water instead of alcohol, the product, instead of being pure and anhydrous, contains 9.3 per cent of water and a large proportion of sulphate. The bisulphite is prepared by the action of sulphurous acid gas in excess upon the alcoholic solution of the carbonate, and, like the sulphite, is formed of white crystals, very soluble in water but nearly insoluble in alcohol; this compound is also anhydrous. Analysis of these two bodies shows that the sulphite of cæsium has the formula Cs_2SO_3 and the bisulphite, $CsHSO_3$. The hyposulphite is another new compound. It is formed by boiling 5 parts of the sulphite of cæsium with 5 parts of flowers of sulphur in 20 parts of water for ¾ hour, renewing the water as it evaporates. The liquid is filtered and evaporated *in vacuo*, and deposits small needle-like crystals which are extremely soluble in water. Analysis shows that the hyposulphite has the formula $Cs_2S_2O_6$. The hyposulphate is the last of the present series. To form it, a solution of sulphite of cæsium and of dithionate of barium are mixed below 60 deg. C., then filtered and crystallized. In this way very fine colorless crystals are obtained, which have the form of transparent hexagonal tables measuring about ¼ inch in diameter and 1-10th inch in thickness. This compound acts like the hyposulphates in general under the action of heat, and decomposes into sulphate and sulphite. It crystallizes in the anhydrous form, and has the composition $Cs_2S_2O_6$.

A CURIOUS MEANS OF DEFENSE.

BY CHARLES FREDERICK HOLDER.

Ten or twelve years ago I began a collection of the so-called horned toads along the base of the Sierra Madre Mountains, in the San Gabriel Valley, California, with the view of testing their powers of mimicry. These lizards were very common here, and it was an easy matter to corral twenty or thirty. They were well protected by their power of simulating the color of their immediate surroundings, and it was often difficult to see or distinguish them from the ground upon which they rested. Those on dusty roads were dust-colored; those found among the rocks were frequently mottled, while nearly all of the specimens observed near the base of the mountains, where there was abundant verdure, were highly colored with vivid tints of yellow, red, brown and white.

These specimens were divided up into pairs and placed in enclosures 2 feet square, with a wooden fence 3 inches in height, so that there was perfect light from above. Each corral was arranged with a different colored floor; thus one had a white sand bottom; the next was green, the next brown; a fourth black and white—in all a number of changes being produced by the arrangement of pebbles, leaves and sand. In these corrals the lizards were released and changed about that their adaptation to new surroundings might be observed. But it is not to this remarkable protective faculty that attention is called, but to a protection so singular that it might well be conceived to be an effort of the imagination.

In handling the lizards, which are perfectly harmless, despite their warlike array of spines, I noticed that, although I had treated them gently, my hands were spotted with blood, and upon examining one of the animals I found that its eyes were suffused with blood, while in another specimen its eye appeared to be destroyed, or represented by a blood spot. I at first assumed that while together the animals had injured each other with their spines; but suddenly, when holding a lizard near my face, it depressed or lowered its head, and I immediately received a fine spray-like discharge, which proved to be blood. A glance at the animal showed that its eyes were bloody, as though ruptured. The volley had come so suddenly that I did not see it, but I was convinced that in some way the lizard had ruptured a blood vessel in its eye and had forced the fluid through the air a distance of at least a foot.

I immediately began to experiment with the little captives, and found that the above explanation was the case beyond question; but only a small percentage of the lizards could be induced to respond to my methods; giving them slight taps on the head seemed to exasperate them the most, and they would lower the head convulsively, the eye would be depressed, and a jet of thick blood, or blood which congealed very quickly, would be shot in a delicate stream to an extraordinary distance. Suspecting that the lizards did not consider me a dangerous enemy, and that I would have better success with some animal, I called in the aid of a fox terrier, for which the little creatures evinced the greatest fear. When the dog placed his nose near them, they crouched low and endeavored to shuffle themselves under the sand out of sight; but when the dog was urged on, and began to bark, they would draw back, hiss slightly, then depress the head, and the white face of the enemy would at once be spattered with drops of blood. Such a discharge was very effective, and, when received in the nostrils, it caused the dog no little annoyance, and he ran around excitedly for a moment vainly endeavoring to rid himself of the fluid, which evidently had some disagreeable feature.

To ascertain the distance to which the lizard could eject this stream from its eyes, I urged the dog to alarm a fresh specimen, and held a large sheet of white paper two feet in front of it, which was soon spattered with little drops of blood, which were hurled by the lizard with remarkable force, covering an area of 4 or more inches, evidently in its efforts to reach its tormentor, that was now very careful and appeared to have a wholesome dread of the peculiar secretion, which was undoubtedly an irritant. One of the lizards appeared to discharge the blood from both eyes, which immediately had the appearance of being ruptured. Another used but one eye, while still another repeated the discharge, though in less quantity and with decreased force.

It is interesting to note that this peculiarity has been observed by others. Mr. Vernon Bailey, of Kernville, Cal., wrote as follows to Dr. Stejneger, the letter

being printed in the Report of the National Museum for 1898:

"KERNVILLE, Cal., July 11, 18—

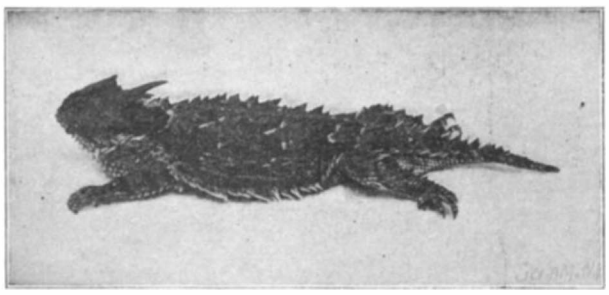
"Dear Sir: I caught a horned toad to-day that very much surprised Dr. Fisher and myself by squirting blood from its eye. It was on smooth ground, and not in brush or weeds. I caught it with my hand and just got my fingers on its tail as it ran. On taking it in my hand a little jet of blood spurted from one eye a distance of 15 inches, and spattered on my shoulder. Turning it over to examine the eye, another stream spurted from the other eye. This he did four or five times from both eyes, until my hands, clothes and gun were sprinkled over with fine drops of bright red blood. I put it in a bag and carried it to camp, where about four hours later I showed it to Dr. Fisher, when it spurted three more streams from its eyes. One of the same species, that I caught July 2, evidently did the same, as I found its head covered with blood when I caught it, but supposed it was injured in the weeds. It seems so strange that I send the horned toad to you alive.

"VERNON BAILEY."

In none of the discharges observed by me was there a large quantity of blood, but Dr. O. P. Hay states that from one he held a quarter of a teaspoonful was thrown. The lizard is *Phrynosoma blainvillei*, and the genus and its various species are found in central and southern California and in Mexico. In appearance it is disagreeable, but in reality the animal is perfectly harmless. The head is armed with spines, as, indeed, is the entire body, which, in the largest specimens, is about 5 inches in length. This lizard frequents the hot plains, as a rule, though it is also found in mountain regions. When approached, it usually depends upon its protective resemblance, crouching flat; then, when it fully realizes that it has been seen, it darts off with an absurd scrambling and waddling gait, making very good time; but it is easily caught. At first it bends its body, twists its horned head against the hand, but in a short time becomes perfectly tame. A speciment kept by me was very fond of being scratched upon the side, and would tip its body upward in response until it was virtually standing upon its side.

The lizard is the common horned toad of commerce, and constitutes one of the most popular "curiosities" of the West, hundreds being taken away alive every winter, while thousands are mounted and sent East to the various dealers in curiosities.

Since writing the above, Mr. Wakeley, a well-known collector, of Pasadena, who has probably handled more "horned toads" than anyone in the country, informed me that he has seen the blood forced from a lizard with such force that it struck the wall 6 feet away, and could be heard as it struck. He is convinced that it comes from the eyelid. Mr. Wakeley has collected and handled thousands of the lizards, and stated that the defense was often employed by them.



HORNED LIZARD WHICH EJECTS BLOOD FROM ITS EYES.

INCREASING USE OF OIL ON HIGHWAYS.

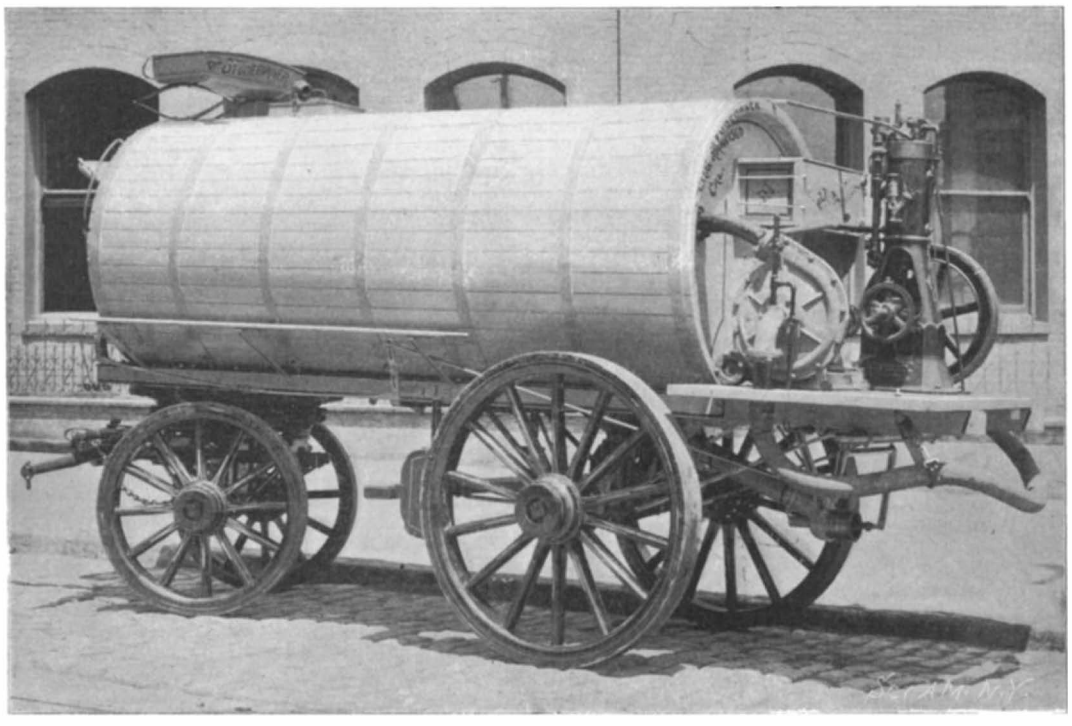
The use of oil upon the streets and highways in California is becoming more and more general, and the number of communities adopting the innovation is constantly enlarging. The system meets with favor as affording an outlet for a great portion of the oil now produced in large quantities, and at the same time as possessing real merit, inasmuch as by its use the condition of the roads is much improved and the comfort of the traveler greatly increased.

The city and county of Sacramento have, after conclusive experiments, adopted the plan, and the results have proved most satisfactory. The oil was applied hot and cold, the first giving the best results. Heated to a temperature of 180 deg. in a boiler adapted for the purpose the oil was pumped into the sprinkler and then sprayed over the roads. The tanks, boilers, pumps and injector cost about $1,000. The experiment proved the decided economy over the water system, besides lessening the cost of the maintenance of the roads, giving a hard, smooth surface and allowing increased loads with a decreased strain upon horses. Sprinkled with oil the roads are practically dustless, while the injury to rubber tires was found to be practically nothing. The first application requires one-third more oil than subsequent ones; two, in some cases one, applications a year is all that is ever required.

The city of Catton, in Southern California, computes that the expense of sprinkling its streets with oil has reduced the expense from $1,200 a year to $745, a saving of 45 per cent.

In the County of Kern 100 barrels of oil to the mile on roadways 12 feet wide sufficed for the first application, and 60 barrels for the second, six months later, secured permanently good results with generally improved condition of the highways. A contract was let to one oil company by which a road was first harrowed superficially and heated oil applied, with a result that confirmed the success of the process. The entire cost was covered by the payment of $1 a barrel for the oil. In Los Angeles, a large producer of mineral oil, the custom is fixed and all its delightful drives are sprayed with oil. The cleanliness and perfection of condition of the streets of that city is remarked by Eastern tourists as a most enticing feature of the place. In San Francisco, where the streets are mostly paved with basalt blocks or asphalt, sprinkling with oil has not been tried as a civic measure, but the commissioners of Golden Gate Park, in defiance of public opposition, concluded to make an experiment on an extensive scale on the main driveway of the park. This thoroughfare is 4½ miles long, and extends from one extremity of the park to the other, with an average width of 35 feet. Thousands of vehicles and a multitude of individuals pass over it every week. The roadway is scientifically constructed, and is as perfect an example of a dirt road as it is possible to make. The first application consumed 6,000 barrels of oil, costing about $1 a barrel, and the surface was thoroughly saturated. In soft spots the process was repeated. For a time the odor was objectionable, but this soon disappeared through the action of wind and sun. There was no damage to clothing, as anticipated, and for a time the driveway was avoided by persons with wheels, but whatever inconvenience was temporarily caused by its means soon vanished as the marked improvement in the drives became perceptible. Time has demonstrated the efficiency of the application of oil to the roads. The surface is impacted and firm, giving the same character to the drive as if covered by asphalt, and at the same time the visual appearance of the park has greatly improved. For eight months of the year, during which there is no rain, the clouds of dust arising from the dirt roads settled upon the foliage, turning it into a hue of dirty red marring one of the exceptional beauties of the park. Since the application of oil the dust no longer flies and the verdancy of the trees and plants is no longer obscured. The economy of oil over water for sprinkling is demonstrated. The commissioners estimate a saving of $500 a month on the one driveway alone, besides saving 70,000 gallons of water in each day. Two applications a year is all that is requisite. The cost of oil is now 87½ cents a barrel.

The sprinkler commonly used differs in no respect from that in which water was distributed excepting in respect to a regulator being attached which produces a fine spray of oil. An engine is sometimes attached to the tank where the oil is not supplied by gravity or when the tank is filled from the heating boiler.



OIL-SPRINKLING WAGON FOR USE ON HIGHWAYS.

Capacity, 1,500 gallons; width of spread, 28 feet.

Novel Use of an Electric Automobile.

We have heard of the application of an automobile storage battery to an X-ray apparatus where a physician was in hurry to complete an X-ray examination; but recently a use of a novel and more general character was made with very satisfactory results.

In Stratford, Conn., there has lately been installed a system of electric lights in the Congregational Church, current being supplied only at night from the neighboring city of Bridgeport. One of the proprietors of the SCIENTIFIC AMERICAN resides in this town and operates an electric surrey.

It happened that one Sunday morning was dark and cloudy, and as no current was furnished during daylight, there was no way to illuminate the dark interior portions of the church except by the use of a few oil lamps.

The owner and his family rode to church in the electric vehicle, then ran it under a window in the rear of the church, near where the switchbox is located, and, after throwing off the main supply switch, connected the feed wires to the storage battery in the carriage. As the several switches in the panel-box were turned on the church was well lighted up, and remained so through the service. At its conclusion the wires were disconnected and the family and minister taken home in the automobile.

Many in the congregation took it for granted that the lighting occurred from the regular source, and were much surprised upon learning of the method of supplying the electric current that was actually used.

Another practical use of storage batteries in boats has come to our notice. A gentleman in Connecticut has a small launch operated by a storage battery; this is charged in the daytime, and when not in use the boat is tied to the dock from which feed wires run (connected with the storage battery in the boat) to his house a short distance away. In the evening he thus uses the battery in the boat to light the house, and finds it a very satisfactory arrangement.

The British government is considering the advisability of sending an engineer to both American and continental cities to inquire into the subway systems and to report on their advantages over the London tubular system.

The Current Supplement.

The current SUPPLEMENT, No. 1342, is of unusual interest. The first-page article is devoted to "Canaigre-Growing in Southwest United States," by John E. Bennett, and is fully illustrated. This new industry is referred to elsewhere in this issue. "Geology and Geography at the Denver Meeting of the American Association for the Advancement of Science," is a report prepared especially for the SCIENTIFIC AMERICAN SUPPLEMENT by E. O. Hovey. "The Food of Nestling Birds" is accompanied by a complete list of all the food gathered for a brood of house wrens in a period of six hours. It is a long and interesting list. "The Mycenæan Question" is illustrated. "Stage Bridges at the Covent Garden Opera House, London, England," describes the latest phase in stage construction. "The Cultural Value of Engineering Education," is by Prof. Frank O. Marvin.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

TREE-PROTECTOR.—CASPAR A. CHISOLM, Charleston, S. C. The object of the invention is to provide a guard for trees which is of such construction that it can freely swing with the trunk, so that the bark will not be chafed. The protector comprises slats held in links. Each link consists of a socket and retaining and connecting pin, the several pins being connected, and each extending to the ends of the socket to hold the slat in the socket.

BAND-CUTTER AND FEEDER FOR THRESHING-MACHINES. — THADDEUS L. CUMMINGS, Hagerty, Iowa. This band-cutter and self-feeder attachment has a number of bundle-carriers or feed-boards which can be moved around a hopper and thus conducted to the band-cutters. The bundle-carriers can be adjusted laterally as well as vertically. The band-cutters are in sets, one set being located above and near the concave and cylinder, while the opposite set of cutters is placed at a point above and in advance of the cylinder and concave. The band-cutter and feeder attachment is applicable to any threshing-machine. The driving mechanism for the belts of the bundle-carriers is not interfered with when one of the carriers is laterally or vertically adjusted.

Electrical Apparatus.

TIME-REGULATOR FOR ELECTRIC MOTORS.—MAX M. MOVSHOVITCH, Manhattan, New York city. This invention relates to improvements for regulating and controlling the time-movement of an electric motor; and the object is to provide a simple, automatic device for this purpose which is especially adapted for use in connection with hands movable over a time-dial, although it will be found useful when the motor is designed to operate other devices at stated divisions of time.

ARC-LAMP.—JOSEPH C. MAYRHOFER, Manhattan, New York city. The object of the invention is to provide a simple, automatic means for separating the carbons to start and maintain the arc, and further so to construct the lamp that flickering caused by jolting will be obviated. The lamp, owing to the fact that it withstands jolting, is readily adapted as a headlight for cars and other vehicles.

MEDICINAL ELECTRODE. — ORVILLE L. LEACH, Providence, R. I. The electrode is designed for applying electric treatment to increase the vitality of animal bodies and by supplying a force which is adapted for the use of organized bodies to give strength and destroy microbes and germs by subjecting them to the force. It is known that the filaments of nerves are tubular; that the nerve impressions are communicated with a spiral movement. It is the object of this invention to provide an electrode so constructed that the electric current passing through it will stimulate the nerve motion.

FLASHER FOR ELECTRIC LAMPS.—CLYDE SLUSSER, Danville, Ill. The invention provides a simple attachment for a lamp by means of which the lamp-current will be automatically cut in and out at regular intervals, giving a flashing effect and making the device particularly useful in show-windows, illuminating signs, and other places where it is desired to attract attention.

CONTACT FOR UNDERGROUND TROLLEYS.—JOSEPH S. GARZOUSI, Manhattan, New York city. The contact consists of a frame having contacts on its ends to connect with the main and the return feed wires at the different points of their length, the contact-frame being freely slidable on its plow. Thus, a proper contact is insured at all times so as to prevent the breaking of the current to the motor and the lamps of the car when passing switches, or the like.

A SYSTEM OF ELECTRICAL INTERCOMMUNICATION.—EMERY A. CLARK, Sioux City, Iowa. The invention is particularly concerned with automatic telephone-exchange systems. The object is to provide a transmitter and receiver by the use of which the action of the system will be rendered more certain, the maintenance thereof more economical, and the establishment of any desired connection easy and rapid. In accomplishing this object the inventor has provided for a continuous forward movement of the switch-wheel of the receiver, employing a circuit making and breaking mechanism operated through the movement of the dial of the transmitter to cause the switch-wheel of the receiver to move forward with a step by step movement for each forward movement of the dial, and to be always in unison therewith. Thus, the subscriber can ascertain the relative position of the switch-wheel of his receiver and know what action to take in order to cause the switch-wheel to establish any desired connection.

ELECTRIC TEMPERATURE-INDICATOR.—FRANK L. JOBSON, 8 South Reservoir Street, Richmond, Va. The device serves the purpose of enabling one to read the temperature of a thermometer from a distance without having to inspect the thermometer itself. It is especially designed for the use of engineers and others who have charge of the regulation of temperature in cold-storage rooms, hospitals, school-buildings, and the like. The invention consists of a special construction and arrangement of a thermometer-tube with terminal contacts fused in exposed relation to the mercury column. A special form of graduated resistance is connected with the terminal and a special form of casing for inclosing the resistance is provided. The whole is adapted for use in combination with a current-meter for indicating the height of the mercury column.

Engineering Improvements.

ROTARY ENGINE.—JOHN W. HICKS, Chicago, Ill. The novel features of the invention are inlet-ports extending through a piston to opposite sides of the piston-head, a rotary abutment being provided for the piston and mounted to rotate in unison therewith. A steam-chest has sets of ports for registering with the ports in the piston. A valve in the steam-chest is under the control of the operator and has ports adapted to register with either set of ports in the steam-chests, the valve also controlling the exhaust of the motive agent of the steam from the working-chamber of the cylinder.

ROTARY ENGINE.—HARDY HESTAND and ARTHUR R. MATTHEWS, Dundee, Tex. The rotary engine comprises a cylinder in which a piston is mounted to turn, provided with a movable head. An abutment having inlet and exhaust ports extends into the cylinder, the abutment having a cam surface for the piston-head to travel on. A spring-valve on the head end of the abutment is arranged to be engaged by a device on the piston so as temporarily to close the inlet port.

Gas Apparatus.

GAS-GENERATOR.—ELIJAH B. CORNELL, Philadelphia, Pa. The object of the invention is to provide an efficient apparatus for utilizing the heat of a furnace for the production of a fixed gas suitable for illuminating and heating purposes, and capable of heating the furnace which serves to generate the gas. Retorts are arranged in sets on the bridge-wall of the furnace, the sets being connected. A steam supply leads to one set of the retorts; and a hydrocarbon supply is joined with the connection between the sets of retorts. The parts are so correlated as to produce an intimately co-acting organization of liquid fuel economizer, in which the well-known form of furnace does double duty and a permanent fixed gas is produced without depositing carbon.

GAS-RETORT.—ELIJAH B. CORNELL, Philadelphia, Pa. The retort is adapted for use in the production of a fixed gas from volatilized hydrocarbons mixed with steam. The object of the invention is to provide a construction by which the gas-forming material will be thoroughly subjected to the action of heat so as to secure a rapid and complete gasification. Each retort consists of a base having an inlet and an outlet with a partition separating them. A shell and an open-end core provided with a contracted end are also provided, the core having its contracted end fitting in the partition. Particular attention should be called to this core, for it forms the gaseous fluid into a thin sheet or film, all particles of which are evenly exposed to the action of heat.

PROCESS OF MAKING GAS.—ELIJAH B. CORNELL, Philadelphia, Pa. The invention relates to the manufacture of gas from steam and hydrocarbons, and more particularly to a process in which the production of a fixed gas is insured. The process consists in forming hydrogen gas; injecting the hydrogen thus formed together with a hydrocarbon oil into a highly heated retort, thereby forming carburetted hydrogen gas; and at the same time subjecting the gas to a series of successive contractions and expansions while highly heated, thereby forming a fixed illuminating gas.

Mechanical Devices.

COIN-CONTROLLED APPARATUS.—MILBERT F. PRICE, Iowa City, Iowa. This coin-controlled apparatus has a coin-chute into which two coin members normally project. These coin members are adapted to be connected with the device with which the coin-controlled apparatus is used, one of the coin members being operated by the weight of the coin, and a push device being connected with the other coin member to permit the manual operation thereof. The machine is particularly adapted for use in the vending of collar-buttons and similar articles.

COIN-CONTROLLED VENDING APPARATUS.—MILBERT F. PRICE, Iowa City, Iowa. This invention relates to a coin-controlled apparatus involving a hand-lever provided with a coin-pocket receiving the coin and also with a dog for imparting movement from the hand-lever, such dog being engaged by the side of the coin to throw the dog into active position. The coin-pocket has a movable wall which releases the coin as the hand-lever moves. The invention is particularly adapted to a collar-button-vending apparatus invented by Mr. Price.

CONCENTRATOR.—PETER C. FORRESTER, Springvalley, Ill. The concentrator is designed for separating or grading the gold sand in placer diggings, where the fine gold has a tendency to float away by reason of the excess of water used in concentration. The concentrator comprises a water-tank in which a vibrating sluice is arranged. Blocks in the bottom of the sluice have varying height, the projections diminishing toward the outlet end of the sluice. An endless belt is movable through the sluice upon the blocks. The material as it is carried upward will be separated by the vibrating motion of the sluice. The values will be carried with the belt around a heating-drum and thoroughly dried.

FIRE-ESCAPE.—CHARLES A. IVES, Manhattan, New York city. Mr. Ives has devised a fire-escape which is simple and durable in construction, cheap to manufacture, ready at all times for immediate use to rescue a number of persons successively from a burning building, and arranged with simple devices for conveniently and safely supporting a person during the descent and allowing the person to regulate the speed of the descent.

NAIL-GRAB.—PAUL J. BENNETT, Cheneyville, La. The invention relates to a device for pulling nails out of a nail keg. The nail-grab used for this purpose comprises a rod having a handle or claw, with which claw-carrying members are pivotally connected, having crossed, slotted arms. A slide is movable on the rod and has pins engaging the arms at their slots. A proper manipulation of the handle causes the tool to grasp the nails.

GEOGRAPHICAL CLOCK.—CARLOS ALBAN, Panama, Colombia. The invention relates to that class of clocks in which provision is made for indicating simultaneously the local time of different cities, and provides a simple construction of clock of this class. The hour-hand can be readily adjusted to the local time of different cities. A peculiar novel arrangement of the openings intended for the insertion of the winding-key is provided.

Railway Contrivances.

STREET-RAILWAY TRACK-SANDING DEVICE.—WASHINGTON H. KILBOURN, Greenfield, Mass. The invention provides a reciprocating feed-box or carrier which receives sand from the hopper and retains the sand for a short time. The feed-box or carrier moves over a conducting-chute. As the carrier reciprocates, it will deliver sand from its end portions to opposing sections of the conducting-chute, the chute being so constructed that all the sand delivered thereto will find an exit at a common outlet.

RAILWAY-SWITCH. — JOHN W. GORDON, Marietta, Ohio. The invention relates to switches for street-railways and means for operating the switch of a moving car on the railway-track. The invention provides novel mechanism for a device of this character, which is practical in operation and which can be controlled from either end of the car as may be desired.

Miscellaneous Inventions.

COLLAR.—FANNY E. MCCATHIE, Port Jervis, N. Y. The collar is a collar for women and is made of washable fabric and provided with a stiffener that can be readily removed or inserted.

SELF-INKING RUBBER STAMP.—ARTHUR E. JAMIESON, Detroit, Mich. The stamp comprises a frame with a cross-rod mounted to slide therein and to which the inking-pad is pivoted. A second cross-rod or bar is connected with the inking-pad and is also mounted to slide in the frame. Springs return the stamp to inoperative position after the device has been used.

TOBACCO-BOX.—JOHN T. CUTTING, Manhattan, New York city. The box is so constructed that it can be conveniently carried in the pocket and that tobacco can be poured directly into the bowl of the pipe without waste. The lid of the box will lock itself to the box, no catch being needed.

LUBRICATING DEVICE.—JOHN W. BOWERBANK, Jersey City, N. J. The lubricator comprises a receptacle for containing the lubricant, provided in its bottom with a transverse slot. A roller-disk is loosely journaled in the receptacle and extends through the slot to engage the peripheral surface of the part to be lubricated. Thus the desired amount of lubricant is fed only during the time the part to be lubricated is run.

DOTTING ATTACHMENT FOR PENS.—HENRY OETTINGER, Manhattan, New York city. This dotting attachment for ruling-pens comprises a casing into which the entire length of the penholder or handle is received. The casing is open at one side. A roller is mounted on the lower end of the casing. A cam-wheel is carried on the shaft of the roller, and a plate is mounted in the casing to engage with the cam-wheel. When the pen is secured in place the device is to be rolled over the paper. During this movement the cam-wheel will cause an upward movement of the plate, consequently carrying the pen upward in engagement with the paper. But as the recesses of the cam register with the end of the plate a dot will be made, since the pen will be allowed to fall by gravity.

COLLAR BUTTON OR STUD.—WILLIAM SWEENEY, Manhattan, New York city. The inventor has devised a separable collar button or stud so constructed that the stem of the hea will enter a barrel connected with the back and lock with the barrel against the tension of a spring located within the head and arranged to bear against the barrel.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1353.—For manufacturers of soluble blue.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 1354.—For manufacturers of double automatic relief check valves.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 1355.—For manufacturers of duplphones and polyhones.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1356.—For manufacturers of forgings such as crank shafts for small steam engines, also parties engaged making crank shafts from steel castings.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1357.—For wholesale dealers in mail order novelties.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1358.—For, manufacturers of chemical laboratory supplies.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1359.—For manufacturers of small castings for dynamos from 10 to 50 volts.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 1360.—For manufacturers of small gas engine castings.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1361.—For manufacturers of ice machines of about 500 pounds capacity daily.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1362.—For parties to manufacture pen holders having hard rubber ferrule, aluminium ferrule, cedar stem and cork covering for the aluminium ferrule.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1363.—For manufacturers of aluminium water pipes.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1364.—For an automatic pump which will stop when a certain pressure is reached, and start again when pressure is decreased.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1365.—For manufacturers of all kinds of bent wood.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 1366.—For machinery for the manufacture of pulp from waste wood. Also information regarding same.

Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 1367.—For manufacturers of round hardwood handles 1 inch by 4 feet long.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1368.—For manufacturers of coal-heading machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1369.—For manufacturers of small handy articles, such as fountain pens, electrical devices, etc.

WANTED.—Good draftsman and designer of ornamental iron work. Must be capable to make working details, and have some experience in this special line. Give experience and state wages desired. Flour City Ornamental Iron Works, Minneapolis, Minn.

Inquiry No. 1370.—For manufacturers of labor-saving devices.

The Board of Health of East Liverpool, Ohio, is now ready to receive plans, specifications and bids for a first class garbage furnace to be built and maintained by the city. For further particulars address J. T. Herbert, Clerk of the Board of Health, East Liverpool, Ohio.

Inquiry No. 1371.—For manufacturers of automatic feeding attachment for tin punching presses.

SEEN FROM THE CAR WINDOWS.—The route of the Lackawanna Railroad between New York and Buffalo is one of the unusual attractions to lovers of scenery. It passes through the most picturesque portion of Northern New Jersey, through the famous Delaware Water Gap, and climbs the Pocono Mountain, disclosing at every turn beautiful distant views of the mountains and valleys of Eastern Pennsylvania. At Scranton it passes through the coal region, and the scene from the car windows is a revelation of the enormous extent of the coal industries of the vicinity. The entire trip is enlivened by diversified scenery of lakes, mountains, streams and thriving cities. The management of the Lackawanna is leaving nothing undone that can add to the comforts of their patrons.—Official Railway Guide.

Inquiry No. 1372.—For machinery for making butchers' skewers.

FOR SALE.—Astronomical telescope, silvered glass reflector, 6½ inches aperture, perfect definition, moderate price. Address P. O. Box 115, Mystic, Conn.

Inquiry No. 1373.—For manufacturers of machinery for cutting, splitting and bundling fire wood.

Inquiry No. 1374.—For dealers in good selling household articles.

Inquiry No. 1375.—For manufacturers of automatic wood-turning lathes and woodworking machinery in general.

Inquiry No 1376.—For manufacturers of small hot-air or gas engines from ⅛ to 1 horse power.

Inquiry No. 1377.—For machinery for handling pine needles, and manufacturing pine needle fiber into various products.

Inquiry No. 1378.—For manufacturers of perforating typewriter type for use on a Remington machine.

Inquiry No. 1379.—For manufacturers of metal corners for use on trunks, valises, etc.

Inquiry No. 1380.—For manufacturers of windmills to generate electricity for lighting purposes on a farm.

Inquiry No. 1381.—For a small drill to drill plug holes in solid granite by power, compressed air or electricity.

Inquiry No. 1382.—For a small generator for running electric drill.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8363) E. E. P. asks: Please inform me in what way will copper wire submerged in a bath of mercury be affected by the latter, particularly whether it will be dissolved. If so, please state what metal would not be dissolved if put in a mercury bath permanently. A. Copper will slowly combine with mercury when immersed in it. The only common metal which is not acted upon by mercury in ordinary circumstances is iron. Mercury used to be imported in iron bottles.

(8364) H. E. H. asks: Metal roofed dwellings are so common here as to be almost the rule for all except the more pretentious ones. I have never known of one being struck by lightning, and have considered them practically immune from damage by lightning stroke. I understand that you do not agree. Do you not think that a house having a metal roof connected with the ground at one or more points, and having a well-soldered piece of heavy wire or iron strap run to the top of each chimney, would be practically immune? Would the ground connection add much to the safety? Would about three strands of No. 8 wire be sufficient for the ground connection, and would it be enough to use but one such connection, that from one low corner? Would connecting of metal spouting with a good ground point near the cistern be of much benefit? A. There are two ways of treating a metal roof and other metallic work upon the exterior of a building in connection with protection from lightning. One is given in rule 7 of our Query No. 8300, in the SCIENTIFIC AMERICAN, Vol. 85, No. 6. "Connect all external metal work, zinc spouts, iron crest ornaments and the like, to each other and to the earth, but not to the lightning conductor." The other way is to solder the lightning conductor as firmly as possible to all these points. The rule above quoted is given by Prof. Silvanus P. Thompson, of London, England, who stands without doubt in the highest rank. To leave the metal of the roof unconnected with the earth is without doubt a most dangerous situation. All city houses with metal roofs have the roof connected with the sewers by means of the water conductors, and these are protectors of the best sort. Hence lightning rods are rarely used in cities for ordinary dwellings. Church spires in cities should be protected by rods. We ourselves do not think it matters much whether the metal roof is grounded separately or through the lightning rod; but grounded it should be in every case. We should not think three strands of wire would be sufficient for a house roof-ground connection. We should make a ground at every corner. The leader to the cistern is a very good ground if it dips into the water in the cistern at all times. The note above referred to seems to have been widely read and to meet a need.

(8365) F. S. asks: Can you inform me in your Notes and Queries column of an insulating composition something like marble, hard, but not brittle, that can be molded, pressed or cast to shape in weights under one-half ounce, to take the place of fiber? A. Your request is self-contradictory. A substance like marble and not brittle does not exist. Porcelain in various forms is in use everywhere as insulators, and comes the nearest to what you specify of any substance we know.

(8366) E. E. W. asks: I wish to find out the cost per hour of a 25 candle power light burning kerosene, also the cost, practicability and endurance of a lamp burning acetylene gas per hour in carbide at 25 candle power. Would the acetylene gas lamp be a good substitute for a kerosene lamp? And are they dangerous or troublesome to handle? A. The cost of a kerosene lamp is less than that of an acetylene lamp for same candle power. We have no figures for the cost of a kerosene lamp. These you can easily obtain by trial. An acetylene burner consuming one-half cubic foot per hour is considered a 25 candle power burner. One pound of carbide will yield 5 cubic feet of gas at normal pressure, and feed this burner for ten hours. The cost of carbide varies with the quantity purchased. In 10-pound cans it is usually sold at 7½ cents per pound. In larger lots at a lower figure. At the above price a 25-foot burner costs ¾ cent per hour. Acetylene is as safe as any gas, when unmixed with air or oxygen. If mixed with air it is very explosive. The light of acetylene is very much more concentrated and hence brighter than that of kerosene. Both require a shade for safe use. The eye will be injured by exposure to the light of either. An acetylene light is much whiter than the light of kerosene. It contains more blue rays.

TO INVENTORS.

An experience of over fifty years, and the preparation of more than one hundred thousand applications for patents, at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

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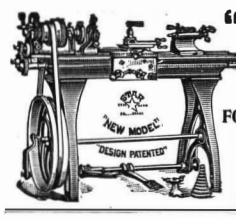
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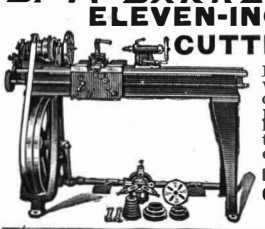
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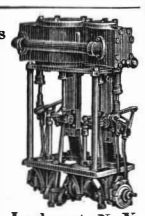
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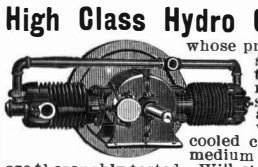
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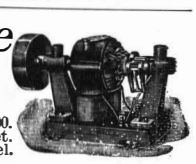
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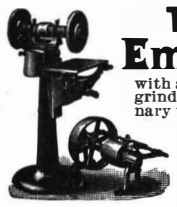
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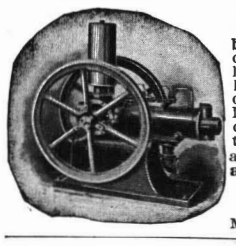
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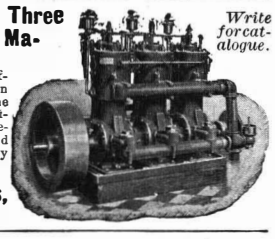
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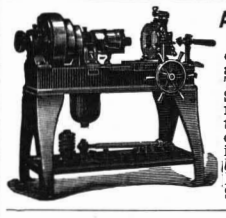
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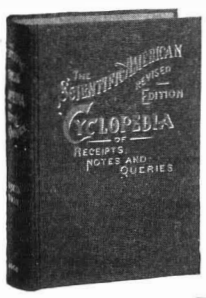

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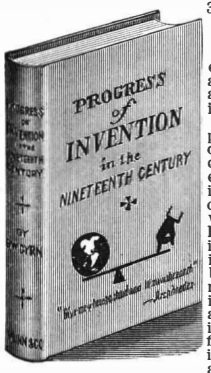

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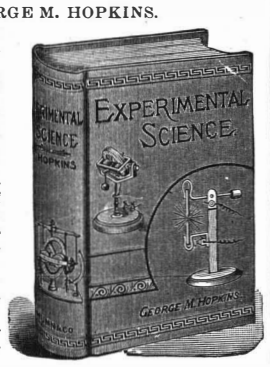

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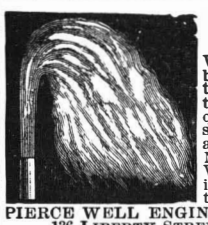

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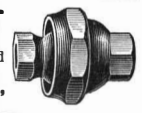

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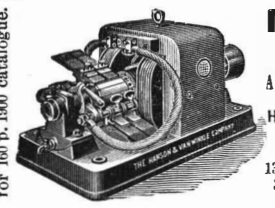

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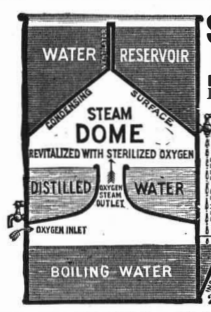

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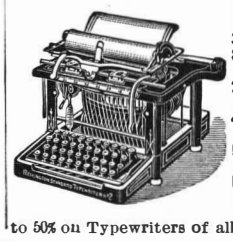

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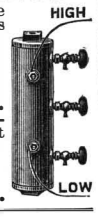

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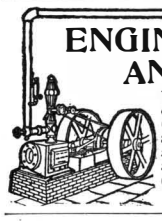

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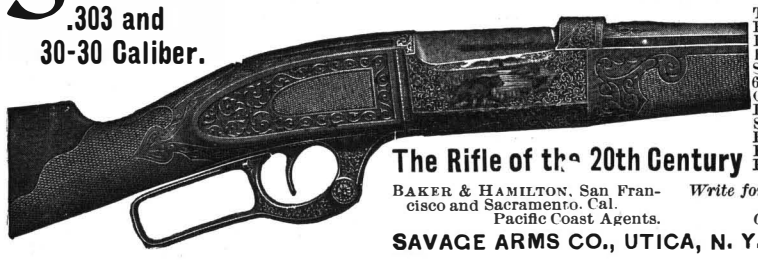

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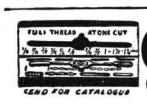

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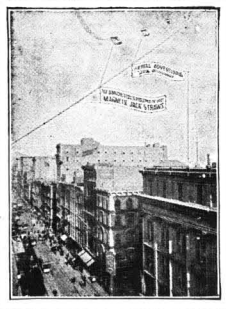

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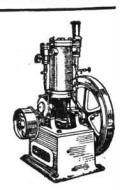

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